UNIVERSITY OF KENTUCKY
WATER RESOURCES INSTITUTE
LEXINGTON, KENTUCKY

SINLINGTHIND

ESOURCESABSTRACTS

VOLUME 1, NUMBER 4 APRIL 1968



Selected Water Resources Abstracts includes abstracts of current monographs, journal articles, translations, and reports. The contents of these documents cover the physical, life, and social science, as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water.

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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 1, NUMBER 4 APRIL 1968

UNITED STATES DEPARTMENT OF THE INTERIOR

WATER RESOURCES SCIENTIFIC INFORMATION CENTER

SELECTIVE STREET STREET, SEC.

WATER SERVICES OF CHESTER AND COMMISSION OF STREET

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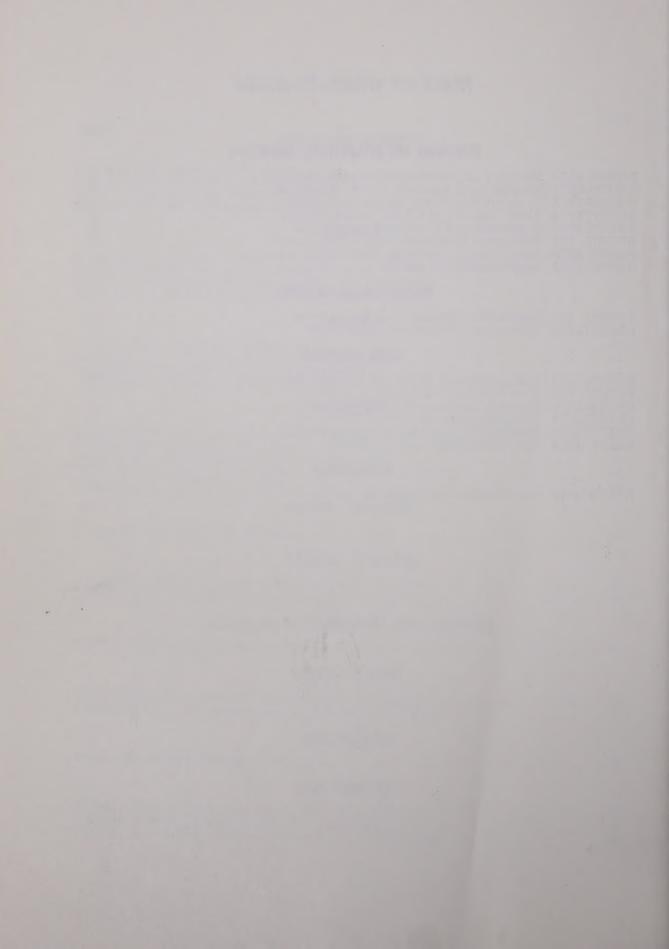
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The speed of data accumulation and the computation accuracy made possible by the computer have been a boon to management by providing information quickly and in a wider variety of combinations than was ever before possible. Quick and accurate presentation of data provided by the computer is designed to give management a broader, more up-to-date data bank upon which decisions can be based. This increased amount of information lessens the areas of uncertainty, reduces the degree of risk-taking inherent in managerial decisions, and provides the basis for a higher degree of operational management not possible using previous systems of data accumulation and presentation. To obtain full value from computer investments, operating personnel must be trained in computer potentials and proper scheduling of computer time. Achieving efficient use of computer facilities is discussed, with specific procedures given for determining the necessity for computer use, program priority, and effectiveness of the computer section as a whole.

R202651X67A

Callahan, J R
MANAGEMENT OBJECTIVE: ECONOMICAL USE OF COMPUTERS
Computers & Automation, Vol 16, No 12, pp 12-17, Dec 1967. Westinghouse
Elec Corp, Sunnyvale, Calif, 6 p
DESCRIPTORS-- *computers/ computer programming/ management/ economics/
data collection systems/ training/ costs/ data processing systems/ systems
analysis/ professional personnel/ instruction/ planning/ *operations/
technology/ scheduling/ forecasting/ personnel requirements/ *decision

IDENTIFIERS -- procedures / *management planning / problem solving / *computer capability / reports / performance

R202674X67A EMPLOYEE MOTIVATION

The modern manager leads indirectly, motivating employees to assume as much responsibility, initiative, and control of their work as possible. He must create an authentic relationship with subordinates so they will understand his expectations and appreciate his consistency, thereby producing an environment in which workers can develop their full potential. To develop such an effective organization from a group of workers, the manager must: (1) have a workable theory of human behavior that gives him an understanding of psychologic laws and theories to understand, predict, and control his employees; (2) recognize individual differences and be able to evaluate each employee in order to establish a basis for that employee's self-development plan; (3) know himself and his weaknesses or limitations and consciously obtain a feedback of his effect on others; (4) learn to play varied roles in the organization to meet the demands of subordinates, coworkers, superiors, and the public; and (5) continue to learn, avoiding obsolescence in a changing industry. Workers may be motivated by their work, achievement, recognition of accomplishment, responsibility, or advancement. These motivators are all more effective than maintenance factors (salary or working conditions) that merely prevent dissatisfaction.

R202574X67A

Morgan, Henry H
EMPLOYEE MOTIVATION
Jour AWWA, Vol 59, No 11, pp 1387-1392, Nov 1967. The Psychological Corp,
New York, N Y, 6 p, 7 ref
DESCRIPTORS -- management/ *leadership/ learning/ organizations/ *personnel
management/ behavior (psychology)/ *motivation/ human behavior/ manpower/
environment/ efficiencies/ psychology/ responsibilities/ incentive awards/
policy matters/ *employee relations/ personnel/ wages/ supervision
IDENTIFIERS -- professional advancement/ recognition/ obsolescence/ working
conditions/ professional development/ evaluation

ADMINISTRATION AND MANAGEMENT

R202690X67A FIGHTING OBSOLESCENCE

The prudent engineer is well aware that the biggest threat to his career is obsolescence. To keep himself off the roster of technical has-beens, he must devote some time every week to study. Because he will want to use his time most efficiently, the engineer should consider the advantages and disadvantages of formal course work and do-it-yourself study. The learning process will be more efficient if the following suggestions are employed:

(1) Schedule regular study periods. (2) Find the best place for study. (3) Concentrate on comprehension. (4) Develop note-taking know-how.

(5) Have a lesson available at all times to be reviewed at free moments throughout the day. (6) Exercise the new knowledge.

R202690X67A

Nypan, Lester J
FIGHTING OBSOLESCENCE
Mach Design, Vol 39, No 30, pp 90-93, Dec 21, 1967. San Fernando Valley
State College, Northridge, Calif, 4 p
DESCRIPTORS-- methodology/ management/ *engineering education/ *engineering
personnel/ *education/ *training/ universities/ *learning/ concentration/
engineering/ motivation/ instruction/ professional personnel/ reasoning/
scientific personnel/ psychology
IDENTIFIERS-- obsolescence/ programmed instruction/ continuing education/
goals

CIVIL ENGINEERING (GENERAL)

R202653X67A DESIGN OF STEEL SUPPORTS FOR TUNNELS

A mathematical approach for the design and spacing of circular steel supports for tunnels is presented. An economical design should utilize the supports as reinforcement for the lining. Necessity of providing supports for the sides and roof of the tunnel and type of support best suited depends upon geological formations and characteristics and properties of rock. When steel supports are proposed, the shape will depend upon the section of the excavated bore and method of excavation. A circular section may be preferred for a tunnel through soft rock. In unstable rock, the shape of the tunnel section should approach that of a full circle. A criterion for the design of lagging is included.

R202653X67A

Gupta, O P
A MATHEMATICAL APPROACH TO THE DESIGN OF CIRCULAR STEEL SUPPORTS FOR
TUNNELS. Water Pwr, Vol 19, No 11, pp 472-474, Nov 1967. Uttar Pradesh
Irrig Dept, Lucknow, India, 3 p, 1 fig, 1 ref
DESCRIPTORS-- mathematical analysis/ design criteria/ design/ reinforcing/
*tunnel linings/ *tunnels/ *steel linings/ ribs/ loads/ rocks/ lagging/
rock mechanics/ thrust/ bending moments/ tensile stress/ foreign design
practices/ plates/ *tunnel design/ tunnel pressures/ *tunnel construction
IDENTIFIERS-- India/ *tunnel supports

Design and construction technology using standard precast reinforced concrete components for standard hydraulic unit blocks of run-of-the-river powerplants has been developed in the USSR and applied to the Saratov Hydroelectric Powerplant on the Volga River. Criteria for the design were: (1) a structure composed of identical unit blocks capable of passing the design river discharge through and around the unit, (2) power factors of units equal to the highest factors of conventional units, (3) smooth hydraulic performance of water passages without energy dissipation within the block, and (4) a design so simplified that all concrete components can be fabricated for handling by production line methods. Soviet planning institutes, after investigations and changes of the 1959 specifications, finally met these criteria. Component types were reduced to 5 by simplifying the block design and using a rectangular turbine case and straight funnelshaped (Moody) draft tube. Model tests showed that spring floods could be discharged safely through the 2 rectangular spillways in each block and that they operated to produce a smooth parallel jet flow, significantly lowering head surges. Design details of the component types and joints are given.

R202702 67A

Rudakov, V N
PRECAST REINFORCED CONCRETE STRUCTURE FOR SARATOV HYDROELECTRIC POWERPLANT
Gidrotekh Stroitel'stvo, No 2, pp 1-8, 1961. Transl from Russ, USBR Transl
652, Aug 1967, 28 p, 5 fig, 3 tab, 1 ref, append
DESCRIPTORS-- hydroelectric powerplants/*concrete technology/concrete
dams/*precast concrete/structural shapes/structural engineering/draft
tubes/*structural design/spillways/rectangular conduits/foundations/
foreign projects/forms (concrete)/joints/cost comparisons/reinforced
concrete/*dam design
IDENTIFIERS-- USSR/ Moody draft tube/*run-of-the-river powerplant/gate
guides/Saratov Powerplant, USSR/Volga Cascade System, USSR/*modular
construction/rectangular turbine cases

R202703X67A INDUS BASIN PROJECT, PAKISTAN

One of the largest civil engineering projects is the Indus Basin Project of Pakistan, being developed as the result of a treaty between Pakistan and India in 1960. Phase I of the Indus Basin Project is the Mangla Dam Project comprising Mangla, Sukian, and Jari Dams and auxiliary tunnels, canals, and diversion dams. In addition to giving a historical review of the dispute between Pakistan and India over their common water resources, a general description of the principal project works is given. Names of design and consulting engineering firms and contractors are mentioned.

R202703X67A

Anon

THE INDUS BASIN PROJECT, PAKISTAN--AN ENGINEERING SOLUTION TO A POLITICAL PROBLEM. Water & Water Engg, Vol 71, No 861, pp 441-452, Nov 1967. 12 p, 7 fig, 7 photo, 1 tab

DESCRIPTORS-- dams/ *earth dams/ projects/ hydroelectric powerplants/ dam design/ irrigation/ international compacts/ spillways/ turbines/ diversion dams/ Francis turbines/ contracts/ flood control/ flood/ wars/ siphons/ canals/ consulting engineers/ contracting/ tunnels/ costs/ civil engineering/ project planning/ foreign projects

IDENTIFIERS-- *Indus Basin, Pakistan/ Pakistan/ *Mangla Dam, Pakistan/ Jari Dam, Pakistan/ Sukian Dam, Pakistan/ Jhelum River, Pakistan/ barrages/ Tarbela Dam, Pakistan

CONCRETE TECHNOLOGY

R202640X67A CONCRETE STRENGTH AND WATER-CEMENT RATIO

Abrams rule relating the strengths of comparable concrete specimens to water-cement ratio remains as one of the fundamental relationships of concrete technology. Several aspects of the strength vs water-cement ratio relationship are examined, such as the effects of age, cement type, type of strength, and type of concrete. Analysis of experimental data indicates relative strength changes caused by a given change in water-cement ratio are greater at earlier ages than at 28-day or later ages, greater for compressive strength than for flexural or splitting strengths, greater for concrete made with Type I rather than Type III cements, and greater for normal-weight than for lightweight concrete. Formulas are presented in an attempt to quantitatively express some of the effects and improve the precision of Abrams formula. Has 38 references.

R202640X67A

Popovics, Sandor FACTORS AFFECTING THE RELATIONSHIP BETWEEN STRENGTH AND WATER-CEMENT RATIO Matls Res & Stds, Vol 7, No 12, pp 527-534, Dec 1967. Auburn U, Ala, 8 p, 7 fig, 3 tab, 38 ref
DESCRIPTORS-- *water cement ratio/ *concrete/ *concrete technology/ curve fitting/ portland cement/ *concrete mixes/ compressive strength/ flexural strength/ bibliographies/ splitting tensile strength/ experimental data/ concrete testing/ mortars/ mechanical properties/ laboratory tests IDENTIFIERS-- empirical equations/ concrete properties/ lightweight

R202644X67A ULTIMATE STRENGTH OF CONCRETE

concretes

Strength of concrete under a sustained load is less than the strength determined by short-time tests. To determine the safety of a structure, the maximum load that safely can be sustained permanently must be found. A brief review is given of direct and indirect methods for determining the sustained load or true ultimate strength of concrete. Direct methods test specimens under different high sustained loads over a long period of time; various investigators have reported true ultimate strength ranges from about 70 to 90% of ultimate strength. Indirect methods of estimating true ultimate strength include the creep test method, volumetric strain method, microcracking observations, and log stress-log strain plots. Indirect methods reviewed show a similar range for true ultimate strength expressed as a percentage of ultimate strength; the authors' experimental work with indirect methods is included. Direct methods of evaluating true ultimate strength are more reliable, but indirect methods involve less time. A combination of several indirect methods is recommended to increase reliability. Has 26 references.

R202644X67A

Desayi, Prakash and Viswanatha, C S
TRUE ULTIMATE STRENCTH OF PLAIN CONCRETE
Rilem Bull, No 36, pp 163-173, Sept 1967. Indian Inst of Sci, Bangalore,
11 p, 8 fig, 4 tab, 26 ref
DESCRIPTORS-- *ultimate loads/ ultimate tensile strength/ *concrete/ creep/
*concrete testing/ bibliographies/ *concrete technology/ tensile strength/
strength of materials/ compressive strength/ laboratory tests/ volume/
reviews/ strain/ stress-strain curves/ loads/ safety/ loading time
IDENTIFIERS-- *sustained loads/ microcracks/ foreign testing/ India/
*ultimate strength

Laboratory tests were conducted to determine drying effects on structural concrete exposed to elevated temperature conditions existing in a flash-evaporation water desalting plant. Creep, compressive strength, and modulus of elasticity were measured on concrete dried at temperatures of 73, 130, 180, 230, and 290 deg F over a period of 6 mo. Results show creep at 290 deg F is about 5 times the creep at 73 deg F. Compressive strength is lowest at 180 deg F; elastic modulus is lowest at 230 deg F and about one-half the modulus at 73 deg F. Variations in concrete properties indicate that possible changes in the composition of concrete occur at temperatures above 180 deg F. Data on strength and moduli changes during storage, strain of unloaded concrete specimens, and weight loss at the different temperatures are reported.

R202700 67A

Hickey, Ken B
CREEP, STRENGTH, AND ELASTICITY OF CONCRETE AT ELEVATED TEMPERATURES
USBR Lab Rept C-1257, Conc & Struc Br, Dec 1967. Bureau of Reclamation,
Denver, Colo, 19 p, 7 fig, 6 tab
DESCRIPTORS-- *creep/ *concrete/ elasticity/ strength of materials/ strain/
*high temperature research/ *concrete technology/ deformation/ mechanical
properties/ concrete structures/ *compressive strength/ *elasticity
modulus/ materials testing/ test procedures/ temperature/ demineralization/
*drying/ dry weight/ *concrete testing/ expansion/ shrinkage
IDENTIFIERS-- sustained loads/ flash evaporators/ weight loss/ high
temperature

R202695 67A CANAL EXCAVATION BY EXPLOSIVES

A 42-km reach of the Amu-Bukharsk Canal and longer reaches of collector drains and feeder canals were excavated by conventional explosives in Uzbek SSR to test the theory and technology of using explosive energy to construct such designed structures. Results of excavating by mass explosions to a design depth from 6.5 to 10 m showed the feasibility of this method. The material excavated varied from porphyrites and sandstones to loams and alluviums; the explosives were TNT, ammonium nitrate, and Igdanit (ammonium nitrate and diesel oil). The costs of excavating soil using the first 2 explosives were about the same as the cost of excavating with conventional equipment, but the cost using Igdanit was 28 to 30% less. Each particular project, however, must be studied carefully as to geology, hydrogeology, and physical-mechanical properties of the soil involved to determine the best method. Evaluating explosive excavation for cost alone fails to consider: (1) shortened construction time, (2) use of simpler machines not requiring power sources or extensions of main roads, and (3) increased productivity of conventional excavating equipment when completing the canal section. Methods of placing the charges, spacing, and amount of explosives used are given.

R202695 67A

Chevkin, A I

EXPERIENCE IN CANAL CONSTRUCTION USING EXCAVATION BY EXPLOSIVES
Gidrotekhnika i Melioratsiia, No 1, pp 64-69, 1967. Transl from Russ, USBR
Transl 730, Aug 1967, 14 p, 3 fig, 4 tab
DESCRIPTORS-- *canals/ explosions/ *explosives/ *excavation/ foreign
projects/ charges (explosives)/ locations/ drill holes/ cost comparisons/
earth materials/ earthworks/ *canal design/ methodology/ *cratering/
craters/ earth handling equipment/ efficiencies
IDENTIFIERS-- USSR/ TNT/ depth of burst/ spacing/ Uzbek SSR/ Igdanit/
depth/ *explosive excavation/ ammonium nitrate/ spaced charges/ *canal
construction

CONSTRUCTION

The major cities of Japan are constructing subways and rapid transit railroads as the first measure to solve the traffic problem. A description of
subway construction methods used in Japan is given. The methods include
opencut, cut and cover, noncovered opencut, shield, caisson, freezing, the
ICOS method, and trenching. Details are given on the construction of the
Ginza Station Complex and the Tokyo subway. Waterproofing linings, underground crossings of rail lines, under river crossings, and underground concrete structures are discussed. The great expansion of subway systems is
requiring such progress in technology that the construction methods
described are already becoming obsolete.

R202705 67A

Mimino, Shin and Irie, Hirato
SUBWAY CONSTRUCTION IN JAPAN
Civ Engg in Japan, pp 21-44, Aug 1967. Teito Rapid Transit Authority,
Tokyo, Japan, 24 p, 26 fig, 17 photo, 4 tab
DESCRIPTORS-- *tunnel construction/ tunnel design/ tunnel linings/ city
planning/ *tunneling/ *tunnels/ *underground structures/ foreign projects/
trenches/ caissons/ freezing/ *rapid transit systems/ shields/ railroads/
transportation/ foreign construction/ construction
IDENTIFIERS-- *subways/ Japan/ Tokyo subway, Japan/ ICOS/ underground
openings

R202706 67A NEW SHIMIZU TUNNEL

In order to meet the increased transportation capacity demand on the Joetsu railroad line in Japan, the 13.49-km-long New Shimizu tunnel was constructed under Mt Tanigawa and approximately parallel to and some 60 m below the existing single-track Shimizu tunnel. Traffic demands required that the tunnel be completed within 4 yr. The tunnel was divided into 3 sections, each approximately 5 km long. Because of complicated geology and slow tunneling conditions, each section required 4 yr for completion. Selection of the tunnel route and geological conditions are described. The fullface tunneling method was selected as the most efficient procedure. Construction progress and equipment are discussed. Technical problems encountered included inaccuracies in geological surveying, groung water, rockbursts, and encounters with hot springs and resulting complaints from hot spring resorts in the area.

R202706 67A

Ikehara, Takeichiro
CONSTRUCTION OF THE NEW SHIMIZU TUNNEL
Civ Engg in Japan, pp 9-20, Aug 1967. Japanese Natl Railways, 12 p, 5 fig,
2 tab
DESCRIPTORS-- *tunnel construction/ tunnel linings/ *tunneling/ *tunnels/
springs (water)/ drainage/ engineering geology/ geologic investigations/
seismic waves/ temperature/ ground water/ rocks/ muck/ costs/ railroads/
foreign construction/ construction/ seismic investigations
IDENTIFIERS-- New Shimizu tunnel, Japan/ Japan/ hot springs/ rockbursts/
tunnel supports

Flood water overflow destroyed a portion of the center training wall of the Bhakra Dam spillway in August 1958. The center training wall (20 ft thick at the base and 5 ft thick at the top) had been constructed to facilitate spillway repairs and designed to withstand the maximum head that would be experienced while repairs were in progress. After the loss of part of the wall, hydraulic model studies were made to determine the cause of the failure. Results showed that turbulence occurring in the hydraulic jump region, accompanied by high vibrations near resonant frequency and rapid differential pressures from 20 ft on one side of the wall to 20 ft on the opposite side, caused the collapse. Pressure cells and an oscillograph were used to measure the instantaneous fluctuations of pressure on the two sides of the wall for various flood flows.

R202688 67A

Uppal, H L; Gulati, T D; Sharma, B A D
A STUDY OF CAUSES OF DAMAGE TO THE CENTRAL TRAINING WALL BHAKRA DAM
SPILLWAY. Jour of Hyd Res, Vol 5, No 3, pp 209-224, 1967. Irrig & Pwr Res
Inst, Punjab, India, 16 p, 8 fig, 2 tab
DESCRIPTORS-- *training walls/ *damages/ concrete dams/ hydraulic models/
*spillways/ piers/ models/ piezometers/ oscillographs/ turbulent flow/
turbulence/ hydraulic jumps/ flow/ pressures/ pressure measuring equip/
*failure (mechanics)/ vibrations/ nappe/ water surface profiles/ eddies/
hydraulics/ foreign design practices/ air entrainment
IDENTIFIERS-- *Bhakra Dam, India/ *differential pressure/ flow patterns/
India/ foreign research

R202636 67A RADIATION LOGS IN GROUND WATER HYDROLOGY

Inexpensive portable radiation logging equipment has been developed in connection with a general research project on the application of borehole geophysics in ground water hydrology. Data can be obtained on source, velocity, and chemical quality of ground water; location, extent, geometry, bulk density, porosity, permeability, and specific yield of aquifers and associated strata; and position of casings, casing collars, leaks, perforations, and cement. The radiation logs employed include natural gamma, gammagamma, neutron-gamma, neutron epithermal-neutron, and radioactive tracer. Radioisotopes used were cobalt-60, plutonium-239, americium-241, and iodine-131. Typical radiation logs obtained by various techniques are described and examples given of applications of radiation logging to ground water investigations. Applications cited are studies of perched water in basaltic rocks and associated sedimentary strata; porosity, moisture content, and position of zones into which water was injected in volcanic tuff; position of the interface between brine and fresh water in fine-grained carbonate rocks and associated fine clastic rocks; interpretation of porosity from a neutron log; and location by means of a radioactive tracer of the more permeable fracture zones in a well penetrating crystalline rock.

R202636 67A

Keys, W Scott
THE APPLICATION OF RADIATION LOGS TO GROUNDWATER HYDROLOGY
Proc, Intl Atomic Energy Agency Symp on Isotopes in Hydrol, Vienna,
Austria, pp 477-488, 1967. USGS, Denver, Colo, 12 p, 4 fig, 6 ref, disc
DESCRIPTORS-- *ground water/ *boreholes/ gamma rays/ *logging/ geophysics/
*radioactive isotopes/ groundwater geology/ neutron counters/ aquifers/
*tracers/ cobalt/ perched water table/ groundwater flow/ wells/ injection/
density/ *drill holes/ porosity/ well casings/ geologic investigations
IDENTIFIERS-- *radiation measuring equip/ iodine/ americium/ gamma probes/
radiation detectors/ cobalt isotopes/ plutonium isotopes/ iodine isotopes/
americium isotopes

DRAINAGE AND GROUND WATER

DRAINAGE AND GROUND WATER

R202668X67A WELL DESIGN AND ELECTRIC ANALOG MODELS

An analysis was made of the characteristics of pumped wells appearing at pumped well junctions of electric analog models as a result of using classical design equations. A comparison was made between the flow properties adjacent to pumped well junctions for standard and modified vector volumes of resistors. The comparison indicated that a pumped well on the analog model has a radius given by the grid interval divided by 4.810 when the resistors have been designed with the standard vector-volume equations. Computed practical sustained yields of aquifers are invalid if obtained from electric analog model studies which do not consider characteristics of the pumped wells. Because the normal radii of pumped wells are much less than the radii indicated above, significant error occurs in the drawdown at pumped wells on the model. Methods are outlined for designing partial penetrations, gravel pack designs, and turbulence loss constants into the analog model pumped wells having differing radii. These methods can be used to design pumped wells into electric analog models that have the same characteristics of existing or contemplated wells.

R202668X67A

Prickett, T A
DESIGNING PUMPED WELL CHARACTERISTICS INTO ELECTRIC ANALOG MODELS
Ground Water, Vol 5, No 4, pp 38-46, Oct 1967. Illinois State Water
Survey, Urbana, 9 p, 9 fig, 1 tab, 11 ref
DESCRIPTORS-- *electric analogs/ *wells/ models/ *ground water/ aquifers/
two-dimensional/ water yield/ well screens/ well casings/ oscilloscopes/
electric potential/ ohmmeters/ analogs/ characteristics/ gravels/ water
table/ electrical resistivity/ drawdown/ errors/ model tests
IDENTIFIERS-- pumping

R202698X67A GROUND WATER IN A TWO-LAYER POROUS MEDIUM

Methods used by the Jaroslav Cerni Institute Hydraulic Laboratory of Yugoslavia to solve ground water problems and analyze water balance parameters are described. Particular attention is given to the method of studying ground water regimes in a 2-layer porous medium using the limiting anisotropy principle. The 2-layer porous medium is considered as overlaying an impervious substratum with the lower layer acting as the aquifer and the upper layer being less permeable. Flow in the lower layer is thus under pressure and considered to be horizontal, while flow in the upper less permeable layer is vertical. Solutions for various problems of steady and unsteady ground water flow in 2- and 3-layer media, ground water flow in riverbed plains, and electric analog applications to ground water problems are discussed. Has 25 references.

R202698X67A

Vukovic, Milan
GROUNDWATER IN A TWO-LAYER POROUS MEDIUM
Trans, Inst Vodoprivredu, Jaroslav Cerni, Belgrade, Yugoslavia, Vol 13,
No 39, pp 5-41, 1966. 40 p, 25 fig, 6 tab, 25 ref
DESCRIPTORS— *ground water/ *porous materials/ *groundwater flow/ electric
analogs/ embankments/ rivers/ bibliographies/ water balance/ differential
equations/ anisotropy/ infiltration/ permeability/ *aquifers/ *water table/
drainage/ models/ model tests/ unsteady flow
IDENTIFIERS— *porous media/ Yugoslavia/ barriers/ drains/ equations/
inundation/ finite element method/ formulas/ open drains/ two-part aquifers

Influence of the computer on network theory and the method of solving circuit design problems is discussed. Properties of linear graphs are reviewed, and a matrix formulation of the network problem is described. In addition to the classical mesh, node, and cutset methods, a mixed method of analysis is considered which is applicable to d-c, a-c, and transient problems. Numerical methods of solving linear and nonlinear d-c network problems are discussed, and a new approach to a-c analysis, using the mixed method and a numerical solution of the matrix eigenvalue problem, is given. Extension of this method to the transient analysis of linear networks is explained. Instability in the numerical integration of differential equations is analyzed, and several means of solving the problem are outlined. Has 50 references.

R202654X67A

Branin, Franklin H, Jr
COMPUTER METHODS OF NETWORK ANALYSIS
Proc of IEEE, Vol 55, No 11, pp 1787-1801, Nov 1967. IBM Corp, Kingston,
N Y, 15 p, 10 fig, 1 tab, 50 ref
DESCRIPTORS-- *digital computers/ *analog computers/ design/ circuits/
matrix algebra/ *electrical networks/ theory/ bibliographies/ algorithm/
electrical engineering/ differential equations/ computation/ mathematical
analysis/ integrals/ computers/ analysis/ computer programming
IDENTIFIERS-- *network analysis/ problem solving/ interconnected systems/
eigenvalues

R202656X67A REAL & REACTIVE POWER--ECONOMIC DISPATCH

Transmission line losses have become increasingly important in the development of large integrated power systems. The authors discuss an economic schedule for real power generation obtained by a Lagrangian method and allocation of reactive power generation determined by a gradient method. Alternate real and reactive power requirements for economic system operation are computed until the total production cost is minimized within the limitations imposed by system constraints. Repeated solutions of the network equations are used to incorporate the effects of transmission losses in lieu of a precalculated transmission loss formula. A computer program provides a means to determine optimum use of available real and reactive power generation and plan economically for future requirements. Computer flow charts for real and reactive power dispatch and a simplified flow chart for economic allocation of real and reactive power are included. Results of a sample system calculation are tabulated. The method presented can be used in planning studies to determine operating costs for present and proposed generation and transmission facilities.

R202656X67A

Dopazo, J F; Klitin, O A; Stagg, G W; Watson, M
AN OPTIMIZATION TECHNIQUE FOR REAL AND REACTIVE POWER ALLOCATION
Proc of IEEE, Vol 55, No 11, pp 1877-1885, Nov 1967. American Elec Pwr
Service Corp, N Y, N Y, 9 p, 8 fig, 5 tab, 10 ref
DESCRIPTORS-- transmission lines/ losses/ *electric power costs/ computers/
economics/ *electric power production/ computer programming/ calculations/
scheduling/ bus (electrical)/ charts/ *power system operations/ optimum
use/ flow diagrams/ transmission (electrical)
IDENTIFIERS-- interconnected systems/ reactive loads/ *power dispatching/
*operating costs/ Lagrangian Multiplier Meth/ power grids

ELECTRICAL Engineering

R202658X67A NONDESTRUCTIVE TESTING OF INSULATION

Large savings in generator insulation maintenance and replacement costs can be realized through the use of modern nondestructive insulation testing techniques. One such test involves subjecting the insulation system to a high direct voltage (HDV), with measurement of the resulting current as a function of time and voltage. A new concept of HDV testing and the associated test equipment is presented. This testing concept produces more reliable and useful data on the condition of the insulation system. The new system is designed around a high-stability HDV supply which applies the test voltage at a predetermined continuous rate of rise, thereby permitting accurate measurement of small increments of specimen current. Emphasis is placed on the proper use of guard circuits and high stability of the power supply to eliminate misleading results and permit nondestructive detection of fault paths. Test procedures and the new test equipment are discussed and results of tests on a 76-mva, 13.8-kv generator given.

R202658X67A

McHenry, Bruce L
GENERATOR INSULATION TESTING BY CONTINUOUS TIME-FUNCTION APPLICATION OF
DIRECT VOLTAGE. IEEE Trans, Vol PAS-86, No 11, pp 1329-1333, Nov 1967.
Ontario Hydro, Toronto, Canada, 5 p, 8 fig, 3 ref, disc
DESCRIPTORS-- *electric insulation/ *nondestructive tests/ *maintenance/
replacing/ replacement costs/ test procedures/ test facilities/ absorption/
direct currents/ extra high voltage/ faults (electrical)/ power O&M/ costs/
electrical coronas/ electric currents
IDENTIFIERS-- *stators/ flashover/ *electrical insulation tests/ Canada/
cost savings/ foreign testing

R202659X67A DAMPER FOR GALLOPING CONDUCTOR WAVES

Standing wave effects of galloping conductor motion are analyzed in terms of parameters which may be evaluated in accordance with procedures for dealing with analogous steady-state and transient phenomena in elementary electrical circuits. These parameters are defined and used to determine conditions which must be satisfied to assure completely damped galloping conductor motion. A method is proposed for including the required friction resistance in a practical damper. An illustrative application is described and data are presented suggesting the possibility of achieving sufficient control with only 1 damper per conductor mile of overhead transmission line. The spring washer-type friction resistance damper is compact, trouble-free, immune to atmospheric environment, can be assembled from rugged commercially available components, and presents no unfamiliar engineering principles.

R202659X67A

Kidder, Allan H
PROPOSED FRICTION DAMPER FOR GALLOPING CONDUCTOR WAVES
IEEE Trans, Vol PAS-86, No 11, pp 1368-1374, Nov 1967. Philadelphia Elec
Co, Pa, 7 p, 3 fig, 1 tab, 3 ref, append, disc
DESCRIPTORS-- *transmission lines/ *dampers/ friction/ motion/ energy/
electric analogs/ *mechanical waves/ dynamics/ energy absorption/ analysis/
frequency/ elasticity modulus/ tension/ hysteresis/ wave velocity/
*electric cables
IDENTIFIERS-- *galloping conductors/ traveling waves/ harmonics/ *electric
conductors

A comprehensive series of field tests was made on the Tennessee Valley Authority-South Central Electric Companies' (TVA-SCEC) 160-mi, 500-kv interconnecting line and associated terminal equipment. The tests included energizing at controlled points on the voltage wave and deenergizing a shunt-reactor compensated line with a transient voltage limiting breaker, switching a line and 1200-mva transformer with a 161-kv transient voltage limiting breaker, applying solid persistent and transient arcing faults to a loaded line, and high-speed reclosing after fault clearing. High-speed motion pictures were combined with oscillograms to obtain and relate data. Methods, instrumentation, and results are given. These tests verified the validity of criteria used in line and terminal equipment design and yielded helpful information for planning future 500-kv facilities.

R202660X67A

Newsom, R N; Nickelson, S B; Toler, R W; Merritt, M S, et al STAGED TESTS CN THE TVA-SCEC 500-KV INTERCONNECTION BETWEEN JOHNSONVILLE AND WEST MEMPHIS. IEEE Trans, Vol PAS-86, No 11, pp 1389-1399, Nov 1967. Commonwealth Assoc, Inc, Jackson, Mich; Arkansas Pwr & Light Co, Pine Bluff; TVA, Chattanooga, Tenn, 11 p, 9 fig, 5 ref, disc DESCRIPTORS-- *extra high voltage/ alternating currents/ instrumentation/ *field tests/ transmission lines/ substations (electrical)/ electric power/ faults (electrical)/ circuit breakers/ electric relays/ performance tests/ electrical coronas/ bundled conductors/ design criteria/ oscillographs/ power transformers/ electrical equipment/ motion pictures IDENTIFIERS-- line switching/ *switching surges/ interconnected systems/ lightning arresters

R202663X67A DYNAMIC BEHAVIOR OF A HYDROGENERATOR

Completion of the hvdc transmission line between Benmore, South Island, and Haywards, North Island, New Zealand, has provided an opportunity to make comprehensive transient loading tests on the Benmore hydroelectric generators using precise load control. Results of field tests are reported. A linearized model of the generating units is derived and analog-computer test results are compared with field tests for various loading conditions and a range of governor settings. Methods of calibrating the governor settings are described, and the effect of possible governor non-linearity on dynamic response is discussed. The long-range objective of these studies is to improve governing systems by better understanding factors controlling transient response of hydrogenerators.

R202663X67A

Woodward, J L and Hitchcock, H C
THE DYNAMIC BEHAVIOR OF A HYDROGENERATING SET
Paper 67-WA/FE-41, ASME Winter Ann Mtg & Energy Sys Expo, Pittsburgh, Pa,
Nov 1967. U of Adelaide, Australia; Wellington Elec Dept, N Z, 13 p, 17
fig, 4 tab, 11 ref
DESCRIPTORS-- hydroelectric powerplants/ *electric generators/ *electrical
stability/ Francis turbines/ *speed regulators/ disturbances/ transmission
(electrical)/ electric power/ extra high voltage/ direct currents/ analog
computers/ *field tests/ mathematical analysis
IDENTIFIERS-- outages/ interconnected systems/ transient stability/ load
rejection/ *loading tests/ governors (hydraulic)/ foreign testing/ New
Zealand

ELECTRICAL FURNING

R202669X67A BITSCH HYDROELECTRIC SCHEME

The Bitsch Hydroelectric Scheme is the first stage and principal element of the Haut-Valais Development in the Rhone Valley of Southern Switzerland. All water gathered in the lower and upper levels of the entire development eventually will pass through the turbines at the Bitsch Hydroplant. Waters from all right-bank tributaries of the upper Rhone Valley will be diverted by a catchment scheme to the Gebidem Reservoir formed by a double-curvature arch dam on the Massa River at Gebidem. These waters are of glacial origin and heavily laden with silt, sand, and gravels; therefore, special attention was given to protection of the reservoir against silting. Several schemes of desilting were considered, but the construction of 2 flushing sluices through the dam was the most economical and satisfactorily removed deposits from the reservoir. The Haut-Valais Hydroelectric Development is reviewed, and details of the Bitsch underground powerplant are given. Mechanical and electrical contractors furnishing equipment for the powerplant are listed.

R202669X67A

Stutz, Roman O
THE BITSCH HYDROELECTRIC SCHEME
Water Pwr, Vol 19, No 11 & 12, pp 445-454 & 487-493, Nov & Dec 1967. 17 p,
19 fig, 2 tab
DESCRIPTORS-- electric power production/ project planning/ arch dams/
*hydroelectric power/ hydroelectric powerplants/ sedimentation/ economics/
*sediment control/ glaciers/ runoff/ foreign projects/ pressure tunnels/
foreign construction/ underground powerplants/ slucies/ tunnels/ canals/
electrical equipment/ reservoirs/ Pelton turbines/ mechanical equipment/
switchyards (electrical)/ construction/ suspended solids
IDENTIFIERS-- Switzerland/ Rhone Valley, Switzerland/ catchments/ Gebidem
Resvr. Switzerland/ Bitsch Scheme, Switzerland

R202671X67A PUMPED STORAGE IN GERMANY

Existing pumped-storage installations in the German Federal Republic are surveyed and a study of future installations discussed. The future of pumped storage in the German power industry is examined and importance of pumped storage as instantaneous reserve generation is stressed. Starting times for pumps and turbines is very short (about 70 sec), and a fully automatic changeover from pumping to generation is about 150 sec. Pumped-storage plants are being used to furnish night load to thermal plants, thus eliminating daily starting and shutdown with associated heat losses. At the same time, these pumped-storage installations offer short-notice reserve capacity generation for peaking requirements. The technical development of pumped storage as it relates to conventional hydroelectric practice is discussed. Has 73 references.

R202671X67A

Frohnholzer, Josef
PUMPED STORAGE IN GERMANY
Mater Pwr, Vol 19, No 11 & 12, pp 458-462 & 507-514, Nov & Dec 1967.
Bayerische Masserkraftwerke, A G, Munich, W Germany, 13 p, 15 fig, 3 tab,
73 ref
DESCRIPTORS-- *pumped storage/ *pump turbines/ peaking capacities/ electric
power/ *electric power production/ peak power/ thermal powerplants/ power
system operations/ hydroelectric powerplants/ efficiencies/ construction
costs/ bibliographies/ foreign design practices/ economics/ reservoirs/
geology/ underground powerplants
IDENTIFIERS-- German Fed Republic/ interconnected systems/ operating costs

Input for data acquisition and computer control systems is usually in the form of electrical voltage measurements. The signal levels almost always require some form of conditioning or amplification. Individual sets of signal amplification-conditioning components for each data input channel are not economically feasible, so a time-sharing system is normally used to sequentially switch various input signals into a common channel. These switching networks are called multiplexers if the time-sequencing control circuitry is external or scanners if the control is self-contained. Multiplexer switching components are surveyed to provide a basic understanding and an awareness of characteristics which must be considered in the choice of a multiplexing scheme. The operation and inherent characteristics of electromechanical and solid-state switchers are described. Electromechanical reed and mercury relay devices are well suited for general multiplexing applications. The solid-state insulated gate field-effect transistor has advantages in its great speed and small size and is the best available device for high-speed analog data multiplexing.

R202683X67A

Marks, Richard H
MULTIPLEXING FOR DATA ACQUISITION
Res/Dvlpmt, Vol 18, No 12, pp 24-29, Dec 1967. C P Clare & Co, Chicago,
Ill, 6 p, 10 fig
DESCRIPTORS-- *data collection systems/ *switching circuits/ *electronic equipment/ *instrumentation/ electronics/ transistors/ analogs/ computer systems components/ computers/ control systems/ electric relays/ electrical engineering/ electric switches/ data transmission systems/ design criteria/ electrical properties
IDENTIFIERS-- *multiplexing/ relay systems/ scanning

R202685X67A EDUCATION OF POWER SYSTEM ENGINEERS

Need of the power utilities for competent engineers with specialized training is alarmingly acute. The growing complexity of the industry requires an increased influx of highly trained engineers on the BS, MS, and PhD levels. These men must be specialists in the power field. Ironically, the number of engineers available to the electric utilities is declining rapidly. Few colleges and universities offer specialized courses in the power field. As a result, few graduates are either interested in or qualified to enter the power industry. The prognosis looks grim unless money can be found to strengthen university curricula in power system engineering. Because private utilities will be the actual benefactors of such an improved program, they would be the logical donors of the needed funds. Has 17 references.

R202685X67A

Erdelyi, E A and Barnes, F S
COOPERATION OF UNIVERSITIES AND UTILITIES FOR THE EDUCATION OF POWER-SYSTEM
ENGINEERS. IEEE Spectrum, Vol 4, No 12, pp 71-82, Dec 1967. U of
Colorado, Boulder, 12 p, 17 ref, disc
DESCRIPTORS—— *electric power/ power system operations/ bibliographies/
engineering personnel/ *engineering education/ industries/ *education/
training/ professional personnel/ *universities/ *electrical engineering/
*public utilities/ learning/ schools/ costs
IDENTIFIERS—— cooperation/ obsolescence/ continuing education/ *electric
utilities

ELECTRICAL FUNDINEERING

R202699 67A TRANSMISSION LINE LOSS METER

Heretofore no acceptable method of metering transmission line losses has been established. The installation of metering facilities at each end of a line, using the difference between energy input and energy output, is inherently inaccurate because it requires using the difference between large quantities of similar magnitude, each of which may be in error. A method of metering transmission line losses from one end by using a loss meter is described. The principle of operation involves inserting a miniature representation (model) of the equivalent pi for the transmission line at one terminal, and by application of the proper voltage and current, the losses measured in the model are proportional to the line losses. This method is particularly useful where the point of delivery and metering equipment are at opposite ends of the line and where an adjustment in billing must be made to compensate for transmission losses. The loss meter method provides data useful in administering power contracts and in system operation.

R202699 67A

USBR Elec & Elec Pwr Branches
TRANSMISSION LINE LOSS METER
USBR Lab Rept EP-23, Elec Pwr Br & Elec Br, Sept 1967. Bureau of
Reclamation, Denver, Colo, 35 p, 8 fig, 4 tab, 4 append
DESCRIPTORS-- alternating currents/ digital computers/ electric analogs/
electrical equipment/ electric potential/ electric terminals/ field tests/
*energy losses/ indirect method/ resistors/ measurement/ *metering/ model
tests/ *models/ *scale/ *transmission lines/ wattmeters/ transmission
(electrical)
IDENTIFIERS-- accuracy/ *power losses/ instrument transformers

R202704X67A PUMPED STORAGE PLANT SELECTION

Tumut 3, the largest project in the Australian Snowy Mountains Scheme, will have a generating capacity of 1500 mw and a pumping capacity of 500 mw. Investigation of the most suitable form of plant resulted in the adoption of 250-mw generating units and, to meet the pumping requirements, a choice between three 167-mw direct-coupled pumps and two 250-mw reversible pump-turbines. Investigations and considerations leading to the final selection of the former are described, and the need for critical appraisal of all factors affecting a pumped-storage scheme is emphasized, especially where generating and pumping requirements are not equal and characteristics of the contemplated plant are beyond the current limit of world practice.

R202704X67A

Bray, A N G and Frost, A C H

THE SELECTION OF PUMPED STORAGE PLANT, WITH PARTICULAR REFERENCE TO TUMUT 3

PROJECT. Inst of Engrs, Austrl, Vol 39, No 9, pp 139-150, Sept 1967.

Snowy Mtns Hydro-Elec Authority, Australia, 12 p, 7 fig, 1 ref, disc

DESCRIPTORS-- *pumped storage/ *hydroelectric powerplants/ *pump turbines/
hydroelectric power/ pumps/ pumping plants/ pipelines/ model tests/
excitation/ power transformers/ hydraulic gates and valves/ *Francis
turbines/ costs/ cost comparisons/ design criteria/ hydraulic turbines/
electric generators

IDENTIFIERS-- *Tumut Power Sta, Australia/ Snowy Mtns Hydro-Elect Auth/
Australia/ switchgear/ reversible turbines/ starting/ comparative
studies/ pumping

The necessity of keeping the weight of ehv transformers to a minimum requires insulating oil of higher purity with better dielectric strength. Insulating oil measurements extended to voltages with peak values of up to 1500 kv, with electrode arrangements in the forms of plate-plate, tube-plate, and coaxial cylinders, are discussed. The withstand or mean breakdown values are given for power-frequency voltage, and the 50% breakdown values are given for standard and switching surge waves, together with the scatter ranges. Electric strength is less dependent on the purity of the oil with standard impulses than with power-frequency voltage. With switching surge voltages, breakdown value is dependent on the rise time; its comparatively inconspicuous minimum value lies in the inhomogeneous field with rise times between 100 and 1000 microseconds, depending on the electrode configuration.

R202707 67A

Maier, G

THE ELECTRIC STRENGTH OF INSULATING OIL WITH POWER-FREQUENCY VOLTAGE, SWITCHING SURGES AND STANDARD IMPULSES. Brown Boveri Rev, Vol 54, No 7, pp 368-376, July 1967. 9 p, 15 fig, 4 ref
DESCRIPTORS-- extra high voltage/ *power transformers/ *dielectrics/ test procedures/ *transformer oils/ *electric insulation/ alternating currents/ contamination/ electrodes/ electric fields/ impulse tests (electrical)/ electric potential/ electric currents/ electric arcs/ electrical equipment/ electrical properties
IDENTIFIERS-- *insulating oil/ insulation/ switching surges/ flashover/ foreign testing/ Switzerland

R202652X67A PRESSURE DISTRIBUTION IN FOUNDATIONS

A method is presented for computing vertical displacement and pressure at any point in a foundation material. Foundation settlement or deflection in a foundation material is generally a summation of 4 effects: elastic deformation, compaction of the material, plastic flow, and reduction of pore water. All of these factors affect the deflection in a foundation to some degree, but the effect of 1 is generally predominant, depending on the material present. Pressure distribution in a foundation must be known before the elastic deformation can be evaluated. Tests and experience have shown that the Boussinesq equation gives sufficiently accurate pressure distribution in foundations under a uniformly loaded circular area. The method presented is an application of the Boussinesq equation. Two example problems illustrating the application of the method are discussed.

R202652X67A

Sollid, Erik
PRESSURE DISTRIBUTION IN FOUNDATIONS
Water Pwr, Vol 19, No 11, pp 469-471, Nov 1967. 3 p, 5 fig, 3 tab
DESCRIPTORS-- *foundations/ *pressure distribution/ *elastic deformation/
homogeneity/ isotropy/ vertical loads/ loads/ mathematical analysis/
numerical method/ pressures/ Poisson ratio/ elasticity modulus/ soils/
settlement/ foreign design practices/ flexible foundations
IDENTIFIERS-- *Boussinesq equation

FOUNDATIONS

Useful details of piles and cylindrical caissons presently used in the U S to resist axial loads and a general description of the construction equipment and procedures used to install these units are presented. Methods used to pay for these foundation types are discussed. Selecting a proper type of foundation requires: (1) reliable subsurface information, including acceptable soil samples; (2) knowledge of forces to be resisted at a fixed elevation; and (3) knowledge of costs of competitive types of foundations or a reliable source for these costs. Piles or caissons should be used only when they are needed and prove to be more economical than other foundation types. Primarily, piles are made of wood, concrete, metal, or a combination thereof. Piles of different materials or combinations of materials may be necessary for an individual requirement, since an all-purpose pile does not exist. Discussion of caissons is limited to cylindrical excavations (with or without an enlarged base) made on land and filled with concrete to plan cutoff elevation.

R202686X67A

Mohr, H A
PILE AND CAISSON FOUNDATIONS
Jour of Boston Soc Civ Engrs, Vol 54, No 3, pp 149-194, July 1967. 46 p,
21 fig
DESCRIPTORS-- *piles/ *pile driving/ *pile foundations/ pile spacing/ wood
piles/ pile bearing capacities/ cast-in-place structures/ *caissons/
*foundations/ casings/ reinforced concrete/ prestressed concrete/ precast
concrete/ composite structures/ payment/ materials
IDENTIFIERS-- pile caps/ pile-driving formulas/ jetting/ steel piles/

GEOLOGY AND GEOPHYSICS

R202661 67A ORIENTED DRILL CORES

Oriented drill cores obtained with the Christensen-Hugel Orienting Barrel were used to determine subsurface foundation conditions at Oso Pumping Plant and Pyramid Powerplant, California Aqueduct Project. The orienting core barrel is similar to conventional NX diamond core barrels but has 3 knives mounted at the bottom of the inner barrel and a surveying instrument attached to the top of the core. The knives cut continuous grooves in the core, permitting orientation by the surveying instrument. Operation of the orienting core barrel is described and applications at Oso and Pyramid plants are discussed. The orienting core barrel and borehole TV camera were used at both sites. The borehole camera was ineffective at the Oso plant because of a continuous layer of wall cake in the drill holes. Removal of the wall cake caused caving and prevented use of the borehole TV camera. Oriented core data at Pyramid Powerplant were spot checked with the TV camera. Visibility was poor and TV observation could be made only at interbeds with a very sharp contrast. Oriented core proved to be a reliable and economical method for determining geologic structure.

concrete piles/ construction methods/ belled footings/ cast-in-place piles

R202661 67A

Voloshin, V; Nixon, D; Timberlake, L
ORIENTED CORE--A NEW TECHNIQUE IN ENGINEERING GEOLOGY
Paper, 1967 Natl Mtg of Assn of Engg Geologists, Dallas, Tex. State of
California Dept of Water Resrcs, Palmdale, 18 p, 14 fig
DESCRIPTORS-- borehole cameras/ boreholes/ *core drilling/ cores/ drill
holes/ *drilling equipment/ *engineering geology/ geologic formations/
geologic investigations/ *foundation investigations/ faults (geology)/
subsurface investigations/ beds (geology)/ joints/ surveying instruments/
excavation/ drilling
IDENTIFIERS-- diamond drilling/ drill hole TV cameras/ structural geology/

Oso Pumping Plant, Calif/ Pyramid Powerplant, Calif/ *oriented cores

Photogeology most commonly uses stereoscopic pairs of aerial photographs for collecting geologic data. During the last few years, some interest has been shown in the use of terrestrial photographs in photogeology. To make terrestrial photogrammetry an easily usable tool for engineering geologists and civil engineers, a standard setup has been developed which eliminates the need for complicated photogrammetric equipment or the assistance of photogrammetric engineers. An example showing the application of the method for plotting geologic features of a quarry rockwall and measuring dip and strike of joints and bedding planes is included. Photopairs were taken with a Wild C-12 stereocamera set, having a 120-cm base between the cameras; a Zeiss stereotope was used for the plotting. Dip and strike measurements can be made either with the stereotope or with a parallax bar. Advantages of this method are: (1) features can be recorded accurately on a photograph, (2) plotting and measuring can be delayed until a more convenient time, (3) readings can be spaced evenly over an entire plot, and (4) measurements can be made at inaccessible locations. The method can be applied to other problems such as measuring earth movements, landslides, and excavations.

R202682X67A

Rengers, N
TERRESTRIAL PHOTOGRAMMETRY: A VALUABLE TOOL FOR ENGINEERING GEOLOGICAL
PURPOSES. Jour of Intl Soc of Rock Mech, Vol 5, No 2-3, pp 150-154, 1967.
U of Karlsruhe, W Germany, 5 p, 3 fig, 1 tab, 3 ref
DESCRIPTORS-- *stereoscopic photography/ stereoscopes/ photography/ beds
(geology)/ photographic equipment/ surveying/ surveying instruments/ field
investigations/ optical instruments/ measuring instruments/ *engineering
geology/ quarrying/ geologic investigations/ *photogrammetry
IDENTIFIERS-- parallax/ rock joints/ strikes (geology)/ plotters/ foreign
products/ photointerpretation

R202696 67A BRANTLEY RESERVOIR SITE

The proposed Brantley Reservoir on the Pecos River in New Mexico would be located on mid-Permian evaporite, carbonate, and clastic sedimentary rock formations. The site was investigated by the Bureau of Reclamation from 1961 to 1964 to delimit the contact of evaporite and carbonate facies, establish that the carbonate rocks were a ground water barrier, and determine the site's acceptability as a suitable reservoir basin and damsite. Techniques included coring, percolation tests, water sampling, electric and gamma ray logging, and water table measurements. The rocks form a gently dipping homocline disrupted in places by hydration and solution of evaporites. Karstic terrain prevails in much of the area. The reservoir, on cavernous evaporite and pervious breccia, abuts tight carbonate rocks downdip. Ground water conditions are favorable, leakage will be small, no deep percolation is foreseen, and conservation storage is practical. Brantley damsite on carbonate rocks was determined to be sound. Has 15 references.

R202696 67A

Redfield, Robert C
BRANTLEY RESERVOIR SITE--AN INVESTIGATION OF EVAPORITE AND CARBONATE FACIES Engg Geol, Vol 4, No 2, pp 14-30, July 1967. Bureau of Reclamation, Amarillo, Tex, 17 p, 6 fig, 15 ref
DESCRIPTORS-- *engineering geology/ *geologic investigations/ dolomites/ geologic formations/ dam foundations/ *foundation investigations/ gypsums/ bibliographies/ groundwater geology/ water table/ percolation/ limestones/ reservoir surveys/ reservoirs/ rocks/ geology/ damsites/ *reservoir sites/ subsurface investigations/ wells/ core drilling/ water sampling IDENTIFIERS-- evaporites/ Brantley Reservoir, N Mex/ reservoir storage/ Pecos River/ karst/ anhydrite/ Seven Rivers formation, N M/ McMillan Dam, N Mex/ cavernous rock/ reservoir leakage

GEOLOGY AND GEOPHYSICS

R202697 67A STRONG EARTHQUAKE GROUND MOTIONS

Strong-motion accelerographs have been developed for measuring ground shaking associated with destructive earthquakes. These instruments produce basic data for the design of earthquake-resistant structures. Earthquake ground motion, measurement of ground acceleration, earthquake response spectrum, accelerograph site conditions, and the current status of the strong-motion accelerograph network are discussed. Strong-motion accelerograph studies of strong earthquakes have shown that: maximum ground acceleration on firm alluvium in the epicentral region is about 0.5 g; maximum duration of heavy ground shaking on firm alluvium is about 45 sec: earthquake energy must be assumed to be distributed uniformly over a wide frequency spectrum at a given typical site; and local geological conditions may significantly influence the ground motion frequency characteristics in special cases. The high cost and service requirements of strong-motion accelerographs have stimulated the development of the seismoscope, a simple device requiring no power, little attention, and costing approximately 1/50 the price of a recording accelerograph. Has 16 references.

R202697 67A

Hudson, Donald E
INSTRUMENTAL DATA ON STRONG EARTHQUAKE GROUND MOTIONS
Engg Geol, Vol 4, No 2, pp 31-41, July 1967. California Inst of Technol,
Pasadena, 11 p, 3 fig, 16 ref
DESCRIPTORS-- *earthquakes/ seismology/ *seismic investigations/ seismic
waves/ *accelerographs/ bibliographies/ accelerometers/ vibrations/ earth
movements/ foundations/ engineering geology/ motion/ geophysics/ geology/
seismographs/ instrumentation/ measuring instruments
IDENTIFIERS-- earthquake engineering/ earthquake loads/ seismoscopes

HYDRAULICS

R202664X67A COLUMN SEPARATION OF LIQUIDS IN PIPES

The primary objective of this study is to develop better insight into the mechanics and dynamics of column separation through application of a rational technique for the theoretical analysis and engineering treatment of this phenomenon. Particular attention is directed to the growth, form, and collapse of the vapor cavity in a horizontal pipe of small diameter. Column separation is described and investigated in terms of governing fluid dynamics. Partial differential equations of continuity and momentum, including nonlinear friction losses, are used to mathematically represent the transient movement of liquids in full and partially full pipes. Systems of equations are programmed for numerical simulation of the column-separation phenomenon, using a digital computer and the method of characteristics. Theoretical time-pressure information derived from mathematical simulation is compared with the corresponding experimental information obtained from laboratory investigation. Despite higher-than-anticipated energy losses in the prototype flow, the general comparison of the 2 sets of information is favorable. Has 26 references.

R202664X67A

Baltzer, R A
COLUMN SEPARATION ACCOMPANYING LIQUID TRANSIENTS IN PIPES
Paper 67-WA/FE-16, ASME Winter Ann Mtg & Energy Sys Expo, Pittsburgh, Pa,
Nov 1967. USGS, Washington, D C, 10 p, 9 fig, 26 ref
DESCRIPTORS-- *fluid flow/ *hydraulic transients/ vapor pressures/ pipes/
*closed conduits/ water hammer/ bibliographies/ digital computers/ *fluid
mechanics/ laboratory tests/ differential equations/ analysis/ simulation/
mathematical analysis/ research and development/ cavitation/ *closed
conduit flow
IDENTIFIERS-- *water column separation/ free surface

When a turbine is automatically governed, the surge tank is hydraulically stable only if the cross sectional area of the tank exceeds a certain minimum value. An equation is derived to describe small oscillations in a simple surge tank for a wider range of operating conditions. This equation is presented in a new nondimensional form which facilitates an immediate prediction of surge phenomena when small disturbances are imposed on any given set of steady-state conditions. A characteristic of general form is assumed for conduit friction, and the effect of deviation from the condition of constant hydraulic power delivered to the turbine is considered. Experiments were conducted with a laboratory model simulating a variety of steady-state operating conditions, and surge measurements are presented for comparison with the calculated behavior.

R202666X67A

Duggins, R K
THE STABILITY OF A SIMPLE SURGE TANK
Paper 67-WA/FE-18, ASME Winter Ann Mtg & Energy Sys Expo, Pittsburgh, Pa,
Nov 1967. Nottingham U, G B, 6 p, 8 fig, 3 ref
DESCRIPTORS-- *surge tanks/ *hydraulic turbines/ velocity/ water/ friction/
oscillation/ head losses/ model tests/ curves/ surges/ *stability analysis/
differential equations/ damping/ investigations/ laboratory tests/ speed
regulators/ analysis/ *penstocks/ hydraulic machinery/ fluid mechanics/
hydraulic conduits
IDENTIFIERS-- governors/ stability/ Great Britain/ foreign research

R202670X67A SURGE TANK LOCATION AND SPEED REGULATION

One of the main problems arising during studies made in connection with the general layout of a hydroelectric plant is the plant's ability to follow rapid load changes without serious disturbance to the system through hunting or excessive frequency and voltage changes. Influence of the surge tank location on the regulating ability of the plant, with all other characteristics of the units remaining the same, is studied; a comparison is made with results obtained from calculations for the same plant without a surge tank and with penstocks of varying diameters. Alternative solutions having equal regulating capacities can be considered as equivalent; the final choice then can be based on safety, construction facility, and costs. Equations and computer programs for stability analysis of hydroelectric plants with and without surge tanks are presented.

R202670X67A

Valvis, P G
LOCATION OF A SURGE TANK IN RELATION TO SPEED REGULATION
Water Pwr, Vol 19, No 11 & 12, pp 463-468 & 503-514, Nov & Dec 1967.
Public Pwr Corp Greece, Athens, 11 p, 4 fig, 7 ref, append
DESCRIPTORS-- *surge tanks/ *stability analysis/ hydraulic turbines/ high
pressures/ speed regulators/ computer programming/ hydraulic transients/
hydroelectric powerplants/ systems analysis/ disturbances/ investigations/
*penstocks/ hydraulic machinery/ hydraulic engineering/ economics/ safety/
costs/ locations/ pressure tunnels/ pipelines
IDENTIFIERS-- *hydraulic design/ hydraulic properties/ Greece/ foreign
research

A simplified method of including fluid friction effect and other hydraulic losses in water hammer equations by direct superposition of the elastic effects on the pressure rise caused by very slow closure is presented. Experiments show this method gives accurate results. A valve designed to close under gravity will almost always close in a time that amounts to instantaneous closure. A profiled plug valve is of no value unless the rate of closure is controlled. Formulas for design of valve plug profiles are presented, but further investigation into hydraulic properties of small bore valves is necessary before these formulas can be applied successfully. Tests showed that use of a servocontrol in place of the usual fixed-area pilot orifice of a pilot-operated valve is the most effective way of reducing water hammer. Pressures close to the theoretical value for uniform retardation of water in a pipe (the maximum reduction possible) were observed. The servocontrol mechanism is simple, inexpensive, and commercially practicable.

R202694X67A

Pagdin, B C and Sarginson, E J
THE ANALYSIS AND ELIMINATION OF WATER HAMMER IN SMALL BORE MAINS
Civil Engg, Vol 62, No 727 & 728, pp 179-183 & 343-345, Feb & Mar 1967.
Laycock Engg Ltd, Sheffield, G B; U of Sheffield, G B, 7 p, 12 fig, 4 tab, 7 ref

DESCRIPTORS—— *water hammer/ hydraulics/ losses/ friction/ *plug valves/ analysis/ servomechanisms/ water pressures/ investigations/ flow control/ *pipelines/ fluid friction/ pressure pipes/ values/ experimental data/ closing/ *valves/ mechanical engineering/ hydraulic gates and valves/ water pipes/ head losses

IDENTIFIERS— hydraulic design/ hydraulic pressure/ hydraulic properties/ Great Britain/ foreign research

HYDROLOGY

R202635 67A PROGRESS OF HYDROLOGY

The challenge of hydrology, recent activities, events, and major problems in hydrology and advances in hydrological techniques are discussed. New scientific knowledge and techniques developed in many modern scientific disciplines and recognition of the importance of hydrology in water resources development enable and encourage the hydrologist to advance scientific hydrology. Many programs to promote hydrology have been developed; e.g., the Universities Council on Water Resources and the President's Water for Peace Program in the U S and programs of the International Hydrological Decade. The most important advance in theoretical hydrology is the development of a new concept of dynamic sequential systems for the hydrological cycle, thereby creating new fields of systems, parametric, and stochastic hydrology. Modern scientific instrumentation provides the hydrologist with better tools for solving his problems. The most important of these, such as electronic computers, remote sensing, and nuclear techniques, are examined. Four central problematical subjects facing the hydrologist are reviewed: effects of man on his environment, dynamics of aqueous flow systems, hydrological transport mechanism, and ground water hydrology. Nuclear techniques used in solving various hydrological problems are discussed. Has 19 references.

R202635 67A

Chow, V T
THE PROGRESS OF HYDROLOGY

Proc, Intl Atomic Energy Agency Symp on Isotopes in Hydrol, Vienna, Austria, pp 3-20, 1967. U of Illinois, Urbana, 18 p, 19 ref DESCRIPTORS-- *hydrology/ *hydrologic data/ project planning/ forecasting/bibliographies/ *water belance/ water quality/ aerial photography/ reviews/ nuclear energy/ radioactive isotopes/ gamma rays/ research and development/ watersheds/ evapotranspiration/ computer programming/ simulation/ multiple purpose projects/ remote control systems/ water/ radar IDENTIFIERS-- hydrologic cycle/ International Hydrolog Dec/ stochastic data cimulation/ stochastic models/ tritium/ nuclear technology/ remote sensing/ nuclear engineering

An attempt is made to evaluate methods using radiotracers in streamflow measurements. Basic principles of the tracer method are explained and background information is given. Radiotracers used in stream discharge measurements are discussed and measurements made by different research workers are described. Problems such as adsorption of the tracer and mixing length are discussed, and potential use of the radioisotope as a tracer in routine stream-gaging work is evaluated. At the present stage of development, radiotracer methods do not seem to be ready for routine use in stream-gaging work and can be used only in special cases. Problems relating to safety, transport, and injection must be solved for gamma-emitting radioisotopes. Although tritium is a very useful tracer in some respects, it has the disadvantages of: (1) a relatively long half-life, and (2) disturbing natural tritium levels in the region. An attempt is made to define the objectives of research in the field of radioisotope application in hydrometry.

R202638 67A

Dincer, T
APPLICATION OF RADIOTRACER METHODS IN STREAMFLOW MEASUREMENTS
Proc, Intl Atomic Energy Agency Symp on Isotopes in Hydrol, Vienna,
Austria, pp 93-113, 1967. IAEA, Vienna, Austria, 21 p, 2 fig, 12 ref, disc
DESCRIPTORS-- *radioactive isotopes/ *tracers/ *streamflow/ *water
measurement/ *discharge measurement/ adsorption/ mixing/ stream gages/
gamma rays/ hydrology/ half life/ sodium/ chromium/ phosphorus/ injection/
water sampling
IDENTIFIERS-- tritium/ bromine/ iodine/ gold/ yttrium/ Austria/ foreign
research/ bromine isotopes/ iodine isotopes/ gold isotopes

R202639 67A NUCLEAR-SEDIMENT CONCENTRATION GAGES

Laboratory tests compared 3 sediment concentration gages using attenuation of transmitted gamma rays as a measure of density; 2 gages used cadmium-109 as the radioactive source and 1 used americium-241. Effects of each probe on stream velocity and sediment concentration gradients within the sampling area were considered. Precision and accuracy of laboratory measurements were calculated and calibration curves plotted for static and dynamic conditions. A minimum detectable sediment concentration of less than 500 ppm was obtained with the americium-241 gage. The cadmium-109 gage, least sensitive to small changes in sediment concentration, was developed for remote, unattended, automatic operation and tested under field conditions. Performance of the automated cadmium-109 gage was evaluated in terms of conventional sediment sampling. Interpretation of a single-point concentration of sediment is different from that of an integrated sample. Each gage is designed for a particular application and performs best under certain conditions. In their present state of development, these nuclearsediment concentration gages supplement rather than compete with each other; each provides the hydrologist with information not now obtainable by conventional means or will provide more information at a lower expenditure than is now possible.

R202639 67A

McHenry, J R; Coleman, N L; Willis, J C, et al
PERFORMANCE OF NUCLEAR-SEDIMENT CONCENTRATION GAGES
Proc, Intl Atomic Energy Agency Symp on Isotopes in Hydrol, Vienna,
Austria, pp 207-225, 1967. USDA, Oxford, Miss, 19 p, 10 fig, 1 tab, 10
ref, disc
DESCRIPTORS-- *sediments/ sediment sampling/ nuclear energy/ *gages/
*sedimentation/ suspended sediments/ performance tests/ laboratory tests/
density/ hydrology/ calibrations/ *radioactive isotopes/ x-ray/ *measuring
instruments/ attenuation/ sediment transport/ sediment concentration/
flumes/ cadmium/ *gamma rays/ hydraulics/ montmorillonites
IDENTIFIERS-- *nuclear probes/ *sediment samplers/ sediment yield/
sediment load/ Parametrics sediment gage/ sediment distribution

HYDROLOGY

R202647X67A SEDIMENT TRANSPORT AND DIFFUSION

The lower Columbia Estuary of the Columbia River is filling with bottom river- and ocean-borne sediments, while immediately offshore, obstruction of the natural littoral regime has created vast areas of accretion and erosion. Past investigations, including measurements and hydraulic model tests, reveal a unique pattern of sediment transport and diffusion prevailing in this region. Studies indicate that from October 1962 to September 1963 the total sediment discharge of the Columbia River at Vancouver was 8,400,000 tons, consisting principally of clay and silt with the amount of coarse sediment being about 25% of the total sediment discharge. Annual dredging of part of this material is required to maintain a navigable channel, leading to the conclusion that the estuary is acting as a trap for the collection of bottom sediments.

R202647X67A

Lockett, John B
SEDIMENT TRANSPORT AND DIFFUSION: COLUMBIA ESTUARY AND ENTRANCE
ASCE Proc, Jour Wtrwys & Hbrs, Vol 93, No WW4, Paper 5601, pp 167-175, Nov
1967. U S Army Engrs, Portland, Oreg, 9 p, 1 fig, 3 tab, 5 ref
DESCRIPTORS-- *sediment transport/ sediment sampling/ *diffusion/ dredging/
sediment control/ *estuaries/ tides/ salinity intrusion/ erosion/ jetties/
shoaling/ wave action/ hydraulic models/ channel improvements/ maintenance/
sediment production/ river currents/ hydraulics/ hydrology/ littoral drift/
sedimentation
TDENTIFIERS-- tidal hydraulics/ Columbia River

MATHEMATICS

R202643X67A SOLVING NONLINEAR DIFFERENTIAL EQUATIONS

One of the most difficult problems in applied mathematics concerns the solution of nonlinear differential equations. A technique for solving certain nonlinear ordinary differential equations is presented in a form suitable for use by nonmathematicians. A transformation of the dependent variable is used to associate the unsolvable nonlinear differential equation with a solvable differential equation called the base equation. Tests are given to determine whether the original equation is solvable by a variable transformation, since not all nonlinear equations have this property. For an association to exist between the original equation and the base equation, a set of auxiliary equations must be satisfied; these are the connective conditions relating the various functions appearing in the original equation. By satisfying the connective conditions, the solution to this original equation can be constructed by the use of a functional relationship. The functional relationship is determinable and in essence is the transformation expressing the solution of the original equation in terms of the solution of the base equation.

R202643X67A

Lerman, Robert A and Despautz, Joseph F
ANALYTICAL SOLUTIONS OF NONLINEAR DIFFERENTIAL EQUATIONS
Instrum & Control Systems, Vol 40, No 11, pp 99-102, Nov 1967. Hamilton
Standard, Windsor Locks, Conn, 4 p, 7 ref
DESCRIPTORS-- *differential equations/ *mathematics/ *mathematical
analysis/ *transformations/ linear systems/ nonlinear systems/ integration/
calculus/ methodology/ instruction/ *systems analysis/ engineering/
analysis
IDENTIFIERS-- equations/ analytical method/ problem solving

Engineering design is viewed as a 3-stage iterative process: (1) selecting a structure and identifying the design variables, (2) assigning numerical values to these design variables, and (3) evaluating the design and deciding whether any of the steps need repeating. Although computer-aided design has greatly reduced the time required to evaluate proposed designs. parameter value selection is an area in which computers have not found wide usage. This paper deals with the use of a computer to systematically modify parameters of a given design, thereby generating a sequence of improved new designs at each step. Many engineering design problems can be formulated as inequality constraints on the system response functions and design parameters. Any set of design variables satisfying these constraints is an acceptable design. The best or optimal design may be defined in a meaningful minmax sense and can be found by solving a related nonlinear programming problem involving the minimization of an easily determined objective function subject to inequality constraints. Minimization techniques are described briefly. Has 20 references.

R202655X67A

Waren, Allan D; Lasdon, Leon S; Suchman, Daniel F
OPTIMIZATION IN ENGINEERING DESIGN
Proc of IEEE, Vol 55, No 11, pp 1885-1897, Nov 1967. Bell Telephone Labs,
Inc, Murray Hill, N J; Case-Western-Reserve U, Cleveland, Ohio; Clevite
Corp, Cleveland, Ohio, 13 p, 15 fig, 1 tab, 20 ref
DESCRIPTORS-- *design/ design tools/ *optimum design/ computers/ digital
computers/ *computation/ normalizing/ bibliographies/ numerical method/
*computer programming/ mathematics/ mathematical analysis/ *algorithm/
boundary values/ nonlinear systems
IDENTIFIERS-- iteration method/ optimization

R202684X67A DATA COMMUNICATION REQUIREMENTS

The area in which data communication and computer systems in combination furnish a useful service is growing rapidly, and there are indications of a much greater growth in the future. Communication requirements for the wide variety of different data processing systems fall into 2 basic types: (1) interaction with the machine at human speeds, and (2) information passed from machine to machine. When human interaction is involved, an input speed of 10 to 20 characters/sec is suitable; however, for machine-tomachine communication, channels are needed that can transfer data at 5000 characters/sec. In setting a criterion for transmission accuracy, error rates of the computers with which the circuits are coupled should be considered. Likewise, to facilitate expansion of remote data processing, uniformity of signaling rates and character codes is desirable. The widespread use of computers on a remote basis for inquiry-type operations can be expanded greatly if the low-speed data channel and the terminal represent a user cost similar to present telephone rates. Data processing, when supported by efficient and economical communications, appears to have potential uses far beyond any that have been indicated by current equipment using existing communications channels.

R202684X67A

McPherson, John C
DATA COMMUNICATION REQUIREMENTS OF COMPUTER SYSTEMS
IEEE Spectrum, Vol 4, No 12, pp 42-45, Dec 1967. IBM Corp, Armonk, N Y, 4 p, 7 ref
DESCRIPTORS-- *data transmission systems/ requirements/ *computers/ digital systems/ standards/ systems analysis/ operations research/ characteristics/ networks/ *communications/ technology/ data collection systems/ *data processing systems/ methodology
IDENTIFIERS-- remote data stations/ man-machine systems/ *communication systems/ data elements/ display systems/ information systems/ performance

The economic impact of time-shared computer systems is yet to be felt, despite the considerable attention recently devoted to such systems. For this reason, perhaps, little has been written on the subject of system economics and cost-effectiveness of such systems. However, increasing interest in time-shared systems eventually will stimulate much greater attention toward large-scale centralized computer complexes. The authors discuss several subjects related to system economics and cost effectiveness, including conventional batch processing vs time-sharing, technical design considerations and operating experience factors, scheduling algorithms, computer configuration aspects, hardware and software cost considerations. accounting problems, and pricing techniques. Attention is focused on establishing criteria for system evaluations, primarily for the benefit of the manager who is faced with decisions involving the use of a time-sharing system.

R202689X67A

Bauer, Walter F and Hill, Richard H ECONOMICS OF TIME-SHARED COMPUTING SYSTEMS Datamation, Vol 13, No 11 & 12, pp 48-53 & 41-49, Nov & Dec 1967. Informatics Inc, Sherman Oaks, Calif, 12 p, 6 fig, 1 tab, 2 ref
DESCRIPTORS-- *computers/ economics/ *cost comparisons/ operations/ design criteria/decision making/configuration/*computer systems components/ operations research/ systems analysis/ efficiencies/ requirements/ methodology/ flexibility/ scheduling/ management IDENTIFIERS -- *time sharing/ *batch processing (data)/ software/ computer capability/ objectives/ on-line operation/ hardware (computer)

R202692X67A AUTOMATIC DRAFTING

Automatic drafting machines (ADM) are used primarily for 2 basic purposes -generating drawings (drafting) and converting existing drawings to digital representation (digitizing). Automating the drafting function is best accomplished by the use of digitally controlled drafting machines, analog drafting machines, and incremental plotters. The ADM has 4 advantages which conventional drafting techniques cannot duplicate: speed, accuracy, versatility, and economy. A typical automatic drafting system is composed of the control unit, a send-receive keyboard, an interface unit, a position buffer, and the drafting head. All drafting machines can generate automatically simple geometric shapes such as circles, ellipses, and other second-degree curves. Newer machines can generate many more complex shapes and functions and perform high-speed contouring and curve fitting, interpolation, and fairing. The more sophisticated systems can generate isometric and trimetric drawings, including vanishing-point perspectives. Three types of drafting especially suited to ADM are drawings of parts that can be manufactured or inspected by numerically controlled machinery, master dimension and full-scale loft drawings, and drawings to be reduced by photographic means.

R202592X67A

Lavoie, Francis J AUTOMATIC DRAFTING Mach Design, Vol 39, No 30, pp 94-101, Dec 21, 1967. 7 p, 1 fig, 12 photo. DESCRIPTORS -- *drawing/ *design tools/ *computer systems components/ data processing systems/ computers/ automation/ *digital systems/ analogs/ twodimensional/ electronics/ computer programming/ transformations/ surfaces/ charts/ characteristics/ graphical analysis/ curve fitting/ geometric shapes/ volume/ design IDENTIFIERS -- *automatic plotters/ *display systems/ *digitizers/ man-

machine systems/ computer-aided design/ accuracy/ layout/ schematic diagrams/ electrical design

The use of lightweight, rigid honeycomb materials is well established in construction of aircraft and space vehicle structures and is increasing in industrial applications. Properties and applications of various honeycomb core materials are described. Kraft paper cores are the least expensive. Aluminum generally is used for loads and temperatures too high for paper. Plastic cores are useful at elevated temperatures and for thermal or electrical insulation. Superalloy or refractory metal honeycomb cores are used in high-temperature applications. Strength and stiffness of honeycomb panels are determined by cell size and shape as well as by the thickness and properties of core and face sheet materials. Bending loads are absorbed by face sheets, and the core material absorbs shear loads; the cores also support compressive loads normal to the panel surface. Mechanical properties are listed for typical sandwich facing materials and plastic, stainless steel, nickel alloy, and aluminum alloy cores. A graph showing comparative costs of honeycomb core materials is given.

R202691X67A

Busche, Michael G
TODAY'S HONEYCOMB: LIGHT, RIGID--MORE USES
Matls Engg, Vol 66, No 7, pp 62-66, Dec 1967. 5 p, 6 fig, 4 tab
DESCRIPTORS-- materials/*composite materials/sandwiching/nickel alloys/
mechanical properties/ paper/aluminum/aluminum alloys/plastics/electric
insulation/*building materials/panels/cores/rigidity/stainless steel/
costs/stiffness/thermal insulation/mechanical insulation/construction/
design/geometric shapes/*cellular structures
IDENTIFIERS-- materials engineering/*honeycomb construction/*sandwich
construction

R202662X67A STAY VANE CRACKING ON PROPELLER TURBINES

Water flowing around an obstacle can cause a stable pattern of eddies in the wake of the obstacle, a phenomenon which is self-exciting and generally of no more consequence than that of the wake. Occasionally the frequency of these von Karman vortexes may coincide with the natural frequencies of the structure, resulting in hydroelastic resonance and fatigue failure in the structure. A distinguishing feature of these vortex-induced vibrations is the persistence of a single frequency of vibration, coinciding with one of the resonant frequencies of the structure over a wide range of turbine flows. Damage caused by von Karman hydraulic vortexes to the stay vane structures of the 2 turbines at Ontario Hydro's Little Long Powerplant is reported. Extent of damage is assessed, and the nature of repairs and modifications are discussed. Has 16 references.

R202662X67A

Goldwag, E and Berry, D G
VON KARMAN HYDRAULIC VORTEXES CAUSES STAY VANE CRACKING ON PROPELLER
TURBINES AT THE LITTLE LONG GENERATING STATION OF ONTARIO HYDRO. Paper 67WA/FE-40, ASME Winter Ann Mtg & Energy Sys Expo, Pittsburgh, Pa, Nov 1967.
English Elec Co, Ltd, Netherton, G B; Ontario Hydro, Toronto, Canada, 5 p,
6 fig, 2 tab, 16 ref
DESCRIPTORS-- *hydraulic turbines/ turbine parts/ flow/ *vortices/ stress/
*vibrations/ *stay vanes/ bibliographies/ *fatigue (mechanics)/ repairing/
natural frequency/ fluid mechanics/ wickets/ inspection/ eddies/ strain
measurement/ foreign projects/ resonance
IDENTIFIERS-- Canada/ vibration control/ wicket gates/ Little Long Gen Sta,
Canada

MECHANICAL ENGINEERING

MECHANICAL ENGINEERING

R202665X67A ESTIMATING PUMP EFFICIENCY FROM MODELS

The increasing use of large pumps has focused attention on methods of predicting the efficiencies of prototype machines from results of model tests. Interest in the scale effect between model and prototype machines began as early as 1880, and the first formula for conversion of turbine data was published by Cramerer in 1909. This formula included allowances for differences in size and surface roughness of the machines and mean velocity and kinematic viscosity of the fluid. Surface friction was estimated by a formula requiring evaluation of a hydraulic radius representative of the flow passages in the machine. Recent studies on estimating the efficiencies of large pumps are reviewed and summarized. The general formula for estimating efficiency of a prototype pump from tests of a geometrically similar model is derived, and a selection of formulas for pumps is presented. Has 40 references.

R202665X67A

Kittredge, C P
ESTIMATING THE EFFICIENCY OF PROTOTYPE PUMPS FROM MODEL TESTS
Paper 67-WA/FE-6, ASME Winter Ann Mtg & Energy Sys Expo, Pittsburgh, Pa,
Nov 1967. Princeton U, N J, 9 p, 13 fig, 4 tab, 40 ref, 2 append
DESCRIPTORS-- *pump tests/ *pumps/ *efficiencies/ *model tests/ models/
losses/ bibliographies/ kinetics/ hydraulic machinery/ mixed flow pumps/
propeller pumps/ specific speed/ centrifugal pumps/ impellers/ turbines/
performance tests/ boundary layer/ curves/ energy losses
IDENTIFIERS-- friction coefficient (hyd)/ hydraulic design

METEOROLOGY AND ATMOSPHERIC WATER RESOURCES

R202708X67A COMPUTER ASPECTS OF METEOROLOGY

A long history of large-scale scientific computing is associated with numerical weather prediction. Recently, interest in this field has been renewed as a result of international studies concerning the feasibility of a global observation and analysis experiment preliminary to the World Weather Watch. Physical phenomena occurring in the atmosphere and problems of modeling them for computer analysis are described. The numerical methods commonly used in general circulation models are examined and the relative advantages discussed. An analysis of computer requirements for global weather calculations is developed, emphasizing the need for very fast computers capable of executing the equivalent of hundreds of millions of instructions per second. Gives 30 references.

R202708X67A

Kolsky, H G
SOME COMPUTER ASPECTS OF METEOROLOGY
IBM Jour of R&D, Vol 11, No 6, pp 584-600, Nov 1967. Scientific Center,
Palo Alto, Calif, 17 p, 9 fig, 3 tab, 30 ref
DESCRIPTORS-- *meteorology/ *weather forecasting/ models/ *computer
programming/ weather/ computers/ time/ mountains/ bibliographies/ spheres/
numerical method/ wind (meteorology)
IDENTIFIERS-- *computer capability/ worldwide

In a metropolitan nation, coordination of river basin planning and metropolitan planning becomes important. To achieve this coordination, planning for river basin development must be brought under a unified command, and communities in metropolitan areas must find ways to reach consensus on their common objectives and on plans to achieve them. Changing social and economic circumstances are making urban areas more aware of their river resources. As political power shifts to the urban areas, a larger voice in planning the development of river basins will be gained. Increasing Federal emphasis on metropolitan planning and creation of river basin planning agencies are 2 promising trends in the development of closer coordination in the planning of river basins and metropolitan areas. A general description is given of the Atlanta-Chattahoochee Study undertaken by the Georgia Institute of Technology to learn how development of river basins and metropolitan areas relate to each other.

R202648X67A

Kelnhofer, Guy J, Jr
RIVER BASIN PLANNING AND URBAN DEVELOPMENT
ASCE Proc, Jour Urban Plan & Dvlpmt, Vol 93, No UP4, Paper 5619, pp 151161, Dec 1967. Georgia Inst of Tech, Atlanta, 11 p
DESCRIPTORS-- *river basin development/ *urban areas/ planning/ projects/
project planning/ *cities/ coordination/ agreements/ river basins/ water
supplies/ municipal water/ resource development/ *water development/
social values/ water resources/ economics
IDENTIFIERS-- *regional authorities/ eutrophication/ Chattahoochee River,
Ga/ Atlanta, Ga

R202649X67A WATER RESOURCE PLANS--OUTDOOR RECREATION

The magnitude of the contributions of major water resource projects to recreation environment is assessed, and contributions needed for the future and means of achieving them are discussed. Estimates indicate that major water resource projects provide approximately 10,000,000 acres of water surface and that these projects, together with related lands, furnished over 500,000,000 days of recreation to visitors in 1965. Current projections indicate a need by 1980 of double the reservoir storage capacity in existence 20 yr earlier and triple the 1960 capacity by 2000. Projections for outdoor recreation demand are of similar magnitude. The growing uses of recreation resources associated with water resource projects reflect their great contribution to outdoor recreation, and future needs must be considered fully in planning, developing, and administering water resource projects. Problems and objectives of providing and maintaining a highquality recreation environment at these projects should be understood clearly by all personnel having water resource interests and responsibilities. Through mutual understanding, much can be done to shape and assure the future of water-based outdoor recreation in this nation.

R202649X67A

Jones, Gordon H
WATER RESOURCE PROJECTS AND OUTDOOR RECREATION
ASCE Proc, Jour Urban Plan & Dvlpmt, Vol 93, No UP4, Paper 5652, pp 141150, Dec 1967. U S Army Corps of Engrs, Dallas, Tex, 10 p, 3 fig, 1 tab,
3 ref, append
DESCRIPTORS-- water resources/ project planning/ *outdoors/ *recreation/
reservoirs/ environment/ natural resources/ *resource development/ fish and
wildlife/ population growth/ municipal water/ industrial water/ pollution
abatement/ water storage/ water quality/ projects/ management/ flood
control/ water management/ *recreational facilities
IDENTIFIERS-- Bureau of Reclamation/ Corps of Engineers/ Tennessee Valley
Authority

ROCK MECHANICS

R202676X67A ROCK FRACTURE PATTERNS

Procedures for predicting distribution of stresses in rock structures and around excavations commonly are developed from the theory of elasticity approach, assuming continuous and homogeneous rock or from the soil mechanics approach, assuming highly fractured rock with an irregular crack system. In nature, rock is normally traversed with joints, cracks, or planes of weakness arranged in well-defined patterns extending over large areas. These regular systems of joints and cracks, with particular emphasis placed on the states of limiting equilibrium, are analyzed. Attention is devoted to shear failure. An idealized joint with a saw-tooth profile is examined to determine the influence of joint irregularities on shear resistance. Failure characteristics of a rock mass traversed by a set of parallel plane joints are displayed by a polar diagram; the diagram is used then to derive failure characteristics of materials having various composite crack systems. Anisotropic behavior of these materials is related to the number of differently oriented planes and the coefficient of friction. A system of discontinuous joints is analyzed by a modified Griffith theory.

R202676X67A

Bray, J W
A STUDY OF JOINTED AND FRACTURED ROCK
Jour of Intl Soc of Rock Mech, Vol 5, No 2-3, pp 117-136, 1967. U of
London, G B, 20 p, 15 fig, 10 ref
DESCRIPTORS-- *rock mechanics/ strength of materials/ *stress analysis/
stress distribution/ rocks/ cracks/ *fractures/ faults (geology)/ elastic
theory/ *shear strength/ shear stress/ shear failures/ friction/ shear
planes/ failure (mechanics)/ engineering geology/ anisotropy
IDENTIFIERS-- Griffith theory/ rock joints/ rock dilation/ *joint systems/
Coulomb-Navier model

SOILS ENGINEERING

R202642 67A EFFECT OF WATER CONTENT ON STRAIN IN LOAM

A study was made to better understand the action required of tillage implements to break up a soil mass. Failure within a soil mass can be produced by a wide range of applied stresses. A method is described for measuring axial strain in a remolded loam soil under unconfined axial loading in compression and tension. Using this method, stress-strain relationships for the loam soil were determined for soil-water contents ranging from 2 to 12% by weight. Maximum tensile stress in a soil beam stressed to failure in a modulus of rupture test was computed from the measured stress-strain relationships; this computed fiber stress was approximately 10% greater than the measured tensile strength. Strain energy required to rupture this soil in axial tension, taken as the area under the stress-strain curve, was shown to increase by only 20% for a sixfold increase in tensile strength and to be related almost proportionately to the energy required to produce a fixed degree of soil breakup in a drop-shatter test. Has 19 references.

R202642 67A

Farrell, D A; Greacen, E L; Larson, W E
THE EFFECT OF WATER CONTENT ON AXIAL STRAIN IN A LOAM SOIL UNDER TENSION
AND COMPRESSION. Soil Sci Soc of Amer Proc, Vol 31, No 4, pp 445-450,
July-Aug 1967. CSIRO, Adelaide, Australia; ARS, USDA, Ames, Iowa, 6 p, 10
fig, 1 tab, 19 ref
DESCRIPTORS-- *moisture content/ *axial strain/ *loams/ tensile strength/
tensile stress/ unconfined compression/ remolded soil samples/ soil tests/
bibliographies/ stress-strain curves/ stress/ strain/ failure (mechanics)/
*soil mechanics/ test procedures/ apparatus/ flexural strength/ laboratory
tests/ research and development
IDENTIFIERS-- strain energy/ strain rate

The Louisiana Slope Value Method is a laboratory design method developed to reduce the testing time in determining minimum cement content for use in soil-cement pavement construction. Use of the slope value method results in a decrease in testing time from 32 to 8 days. Testing is easy to perform, and use of the developed correlation curves and tables is simple and rapid. This method makes maximum use of AASHO procedures for wet-dry testing and PCA weight loss criteria and is simply a formalized expression of available statistical data. It is based on a tangible relationship between the susceptibility of different types of soil-cement mixtures to additional cement, as expressed by the slope of the 7-day unconfined compressive strengths developed at respective cement contents, and the wet-dry test losses realized at identical cement contents. This method was compared with the wet-dry test method; 92% of all cement contents recommended were within 2% of those contents called for by the latter method. A detailed procedure for using the slope value method is given in an appendix.

R202675 67A

Kemahlioglu, Ali; Higgins, C M; Adam, Verdi
A RAPID METHOD FOR SOIL-CEMENT DESIGN: LOUISIANA SLOPE VALUE METHOD
Hwy Res Record, No 198, pp 19-29, 1967. Louisiana Dept of Hwys, Baton
Rouge, 11 p, 6 fig, 2 tab, 2 ref, append
DESCRIPTORS-- *soil cement/ soil classifications/ design tools/ laboratory
tests/ compressive strength/ wetting and drying tests/ soil stabilization/
*durability/ portland cement/ test procedures/ unconfined compression/ soil
tests/ design criteria/ *soil mechanics/ base courses/ remolded soil
samples/ research and development
IDENTIFIERS-- *Louisiana Slope Value Meth/ cement content/ weight loss/
test results

R202701 67A SEEPAGE RINGS DETERMINE SOIL PERMEABILITY

USSR hydraulic engineers have examined an American method for determining soil permeability and seepage rates by large concentric rings and recommend its use because of its reliability, especially in layered soils. Other advantages of this method are use of Nesterov's principles for large wetted surfaces, familiar to Soviet soil specialists; simplicity of the test setup and ease of making measurements; and automation capability. Disadvantages are the longer time required for observations and the large quantity of water used. Seepage measurements were conducted on several test plots in the Golodnaia Steppe of Central Asia over a 3-yr period. The 2.6-m-dia metal inner ring set in a 10-cm furrow and the 7.8-m-dia earth outer ring faced with polyethylene film automatically were kept filled with water to a constant depth of 30 cm. Soil moisture was measured by neutron meters inserted into observation drill holes. Before-and-after measurements permitted fixing changes in the position of the wetting front, and with time, computing the wetting and seepage rates horizontally and vertically. Tests showed that wetting rate was at first greater than seepage; but later the rates became approximately equal and the slopes of representative curves became constant, indicating a stable seepage rate.

R202701 67A

Rainin, V E and Makarycheva, E A
DETERMINATION OF SOIL PERMEABILITY BY THE METHOD OF LARGE RINGS
Gidrotekhnika i Melioratsiia, No 1, pp 34-38, 1965. Transl from Russ,
USBR Transl 686, Apr 1967, 13 p, 3 fig, 1 photo, 1 tab, 2 ref, append
DESCRIPTORS-- *permeability/ soils/ soil mechanics/ soil moisture/ ground
water/ soil physical properties/ field tests/ *seepage/ test procedures/
velocity/ measurement/ neutron counters/ meters/ observation wells/ drill
holes/ wet condition
IDENTIFIERS-- seepage rings method/ foreign research/ USSR/ soil moisture
movement/ Golodnaia Steppe, USSR/ *wetting front

STRUCTURAL AND ARCHITECTURAL ENGINEERING

R202645X67A BEHAVIOR OF PRESTRESSED CONCRETE MEMBERS

Experimental test results are presented for 15 prestressed concrete members with unbonded tendons and using 2 cross-sectional shapes. A ribbed crosssectional shape was used for beams tested as indeterminate 2-span continuous members and as determinate double-cantilever members simulating the negative moment region of multiple-span members. An I-shaped section was used for 8 simply supported beams. 4 of which were simple beams with an overhang on 1 end. Web reinforcement was used for only 4 of the 15 beams tested. Bonded reinforcement was included in all cases to distribute cracking in the concrete and contribute to the ultimate moment capacity at critical sections. Development of cracking, ultimate load capacity, and load-deflection response were of interest; some members failed in flexure. while others failed in shear. Test results are compared with values computed following the 1963 ACI Building Code requirements. Both flexural and shear strengths at ultimate are underestimated by the ACI Code. Trends from comparisons of measured to predicted values are discussed for beams having the 2 types of cross sections, and overall trends are presented. Contribution of the bonded deformed bars to strength and behavior of members with unbonded tendons is discussed.

R202645X67A

Burns, Ned H and Pierce, David M

STRENGTH AND BEHAVIOR OF PRESTRESSED CONCRETE MEMBERS WITH UNBONDED TENDONS
Jour of PCI, Vol 12, No 5, pp 15-29, Oct 1967. U of Texas, Austin, 15 p,
11 fig, 6 tab, 4 ref
DESCRIPTORS-- *prestressed concrete/ concrete testing/ *reinforced
concrete/ flexural strength/ reinforcing steel/ test procedures/ codes/
continuous beams/ cross sections/ cracking/ bondings/ deflection/ beams/
failure (mechanics)/ shear strength/ cantilevers/ research and development/
concrete/ ribs/ stress-strain curves
IDENTIFIERS-- I-beams/ beams (structural)

R202650X67A SEISMIC LOAD ANALYSIS OF STEEL STRUCTURES

Seismic lateral design loads and subsequent load distribution to individual members of a multistory, multibay steel-framed structure were calculated as part of preliminary design procedure. Use was made of the general dynamic analysis method of setting up a frame stiffness matrix in terms of joint distortions and then inverting it to obtain the flexibility matrix from which the lateral flexibility matrix is extracted. Dynamic characteristics of the structure are first computed and used to predict the equivalent static seismic loading; then this loading is applied to the framework and the resulting member actions are determined. Consideration is limited to response within the elastic range. Methods used and results obtained from the analysis of a 14-story steel-framed building are given.

R202650X67A

Shepherd, R
SEISMIC LATERAL LOAD ANALYSIS OF A STEEL-FRAMED STRUCTURE
N Z Engg, Vol 22, No 10, pp 407-413, Oct 15, 1967. U of Canterbury,
Christchurch, N Z, 7 p, 4 fig, 7 tab, 8 ref
DESCRIPTORS-- *seismic design/ *steel structures/ *lateral forces/ loads/
*structural design/ structural stability/ analysis/ building codes/ live
loads/ dynamics/ computer programming/ dead loads/ structural analysis/
moments/ *buildings/ foreign design practices
IDENTIFIERS-- New Zealand/ earthquake engineering/ earthquake loads/
*earthquake-resistant struct

Three reasons for designing self-supporting transmission towers with the digital computer are: (1) to obtain a more rapid design, (2) to obtain greater accuracy for reasons of economy and structural integrity, and (3) the desirability of analyzing towers as indeterminate rather than determinate structures. Self-supporting towers are highly indeterminate structures. Until recently, analysis of such structures was done by determinate methods because of the number of calculations required in indeterminate methods. Results from determinate methods were often questionable because elastic properties of members were not considered. Today, complex numerical problems are solved routinely with high-speed digital computers. The author presents a technique for efficiently solving large systems of symmetrical linear equations obtained from an indeterminate method of analysis, without resort to matrix inversion. A procedure is given for incorporating the analysis into a tower design program.

R202657X67A

Jensen, H Gordon

EFFICIENT MATRIX TECHNIQUES APPLIED TO TRANSMISSION TOWER DESIGN

Proc of IEEE, Vol 55, No 11, pp 1997-2000, Nov 1967. Bonneville Pwr Admn,

Portland, Oreg, 4 p, 2 fig, 4 ref

DESCRIPTORS-- *transmission towers/ design/ computers/ elastic theory/ load

distribution/ computer programming/ pin connected joints/ analysis/ matrix

algebra/ *structural design/ structural analysis/ *digital computers/

stiffness/ electrical networks/ flow diagrams/ transmission lines

IDENTIFIERS-- *self-supporting towers/ application techniques

R202677X67A LIMIT ANALYSIS OF A FIXED-ENDED T-BEAM

Limit analysis of a reinforced concrete fixed-ended T-beam is developed and compared with experimental test results. Limit design is one of the important steps toward optimum design of structural systems. The first step in limit analysis is to predict an accurate moment-curvature curve for each critical section in the structural system under study; then moment and curvature diagrams are drawn. Using these diagrams, equations for equilibrium and compatibility can be written; using the equations with a trial-and-error procedure, critical moment values can be found, leading to the determination of ultimate load. Experiments were performed on 3 reinforced concrete T-beams, each with the same dimensions but with varying amounts of reinforcement. Experimental results are compared with the theoretical data. An example illustrating the theoretical determination of the collapse load for a fixed-ended T-beam is presented in an appendix.

R202677X67A

Barker, Richard M and Murray, Kenneth H
TEST RESULTS ON THE LIMIT ANALYSIS OF A FIXED ENDED T-BEAM
Jour of ACI, Proc Vol 64, No 12, pp 820-826, Dec 1967. Virginia
Polytechnic Inst, Blacksburg, 7 p, 7 fig, 3 tab, 4 ref, append
DESCRIPTORS-- *structural analysis/ structural engineering/ laboratory
tests/ *beams/ test procedures/ *reinforced concrete/ *limit design/ fixed
structures/ optimum design/ ultimate loads/ moments/ strain/ moment
distribution/ apparatus/ codes/ compressive strength
IDENTIFIERS-- strain hardening/ curvature/ T-beams

STRUCTURAL AND ARCHITECTURAL ENGINEERING

R202678X67A POST-TENSIONED CONCRETE MASONRY WALL

Tests were performed on a full-sized post-tensioned concrete masonry wall to examine engineering problems of foundation structure interaction. The study was directed toward problems of building on heaving soils. The practical solution in masonry construction encountering this soil condition appears to be the development of a completely rigid structure capable of carrying its own weight under any support conditions, without serious deformation. Results of the test are compared with a design based on a truss analogy and an analysis as a 2-dimensional stress problem using McHenry's lattice analogy. With the exception of sections around the doorway in the wall, agreement between experimental results and the truss and lattice analogy solutions was very good. The wall was shown to be capable of withstanding (without serious distortion or cracking) loads of a magnitude which could be considered equal to those imposed on the wall of a house subjected to the most extreme foundation movements. A load greater than twice this was required to cause structural failure. The test indicates that the problems associated with masonry houses built on moving soils could be overcome by using post-tensioning methods similar to those used in this wall.

R202678X67A

Rosenhaupt, S; Beresford, F D; Blakey, F A
TEST OF A POST-TENSIONED CONCRETE MASONRY WALL
Jour of ACI, Proc Vol 64, No 12, pp 829-837, Dec 1967. CSIRO, Melbourne,
Australia, 9 p, 9 fig, 5 ref
DESCRIPTORS-- *post tensioning/ *prestressed concrete/ *masonry/ *walls/
heaving/ foundations/ rigid frames/ deformation/ structural analysis/
shear failures/ structural design/ cracking/ reinforcing/ laboratory tests/
test procedures/ loads/ concrete
IDENTIFIERS-- foreign research/ Australia/ *concrete blocks

R202679 67A REINFORCED BRICKWORK USED IN BOX BEAMS

A series of full-scale tests was performed on composite cantilever box beams having reinforced concrete slabs as flanges and reinforced brick walls as webs. A savings can be realized by combining the cost advantage of brickwork with the strength and stiffness of box beam construction. Research was conducted to determine: (1) shear force-deflection relationship of the web of the composite box beam and (2) ultimate strength and load factor. Because the cantilever is the simplest structural unit in which these factors may be considered, it was chosen as the specimen to be examined. Special bricks with cutouts to accommodate vertical reinforcing bars were used for the first 2 tests. The walls for these tests were 9 in. thick and contained horizontal reinforcement. Conventional bricks were used in the third test to allow a choice from the complete range of strengths and colors. This wall was ll in. thick with diagonal reinforcing bars in a grouted cavity. The tests showed both wall types had large loadbearing capacity; the wall with diagonal bars performed particularly well. Some comparisons are made of the cost of these composite beams and similar ones constructed wholly in reinforced concrete.

R202679 67A

Plowman, J M; Sutherland, R J M; Couzens, M L
THE TESTING OF REINFORCED BRICKWORK AND CONCRETE SLABS FORMING BOX BEAMS
Struc Fngr, Vol 45, No 11, pp 379-394, Nov 1967. Messrs Harris &
Sutherland, London, G B, 16 p, 25 fig, 5 tab, 2 ref, 3 append
DESCRIPTORS-- *bricks/ *masonry/ concrete/ *box beams/ *slabs/ reinforcing/
laboratory tests/ test procedures/ ultimate loads/ structural behavior/
deflection/ bondings/ cracks/ strain/ stress-strain curves/ cantilevers/
cost comparisons/ *structural engineering/ *walls/ building materials/
beams/ composite structures
IDENTIFIERS-- ultimate strength/ diagonal tension/ bond

The Southwell plot is examined in relation to the initial postbuckling behavior of a structure. Since its inception for column-buckling problems, the Southwell method has been used to determine critical load in frame- and plate-buckling experiments. Although use in these cases has been justified in the context of small deflection theory, little is known about the effect that nonlinearities in such structures have on the Southwell line. Depending on the nature of the postbuckling behavior, the Southwell method may underestimate or overestimate critical load; consequently, knowledge of postbuckling behavior is essential in the correct interpretation of a Southwell plot. Tests were performed on experimental structures consisting of triangulated frames made of high-tensile steel strip. Results of the study indicate that the Southwell procedure can be applied to structures other than columns, but great care must be taken in the interpretation of results.

R202680X67A

Roorda, John
SOME THOUGHTS ON THE SOUTHWELL PLOT
ASCE Proc, Jour Engg Mech, Vol 93, No EM6, Paper 5634, pp 37-48, Dec 1967.
U of Waterloo, Canada, 12 p, 7 fig, 9 ref, append
DESCRIPTORS-- *structural analysis/ *buckling/ structural models/ rigidity/
model tests/ *structural behavior/ deflection/ laboratory tests/ structural
stability/ trusses/ joints/ rotation/ frames/ stress-strain curves/ loads/
elastic theory/ engineering mechanics/ *columns/ struts/ steel structures
IDENTIFIERS-- foreign research/ Canada/ Southwell method

R202681X67A SPACE-FRAMEWORK METHOD

A space-framework model is derived to represent a rectangular, prismatic, solid element assumed to be in a state of uniform stress and having any value of Poisson's ratio. The model consists of edge beams having axial and flexural rigidity and diagonal members in each external face having axial rigidity only; therefore, an equivalent space-framework can be established to simulate the behavior of an elastic, 3-dimensional continuum under applied load, deformation, or both. Two examples are analyzed to illustrate the applicability of the space-framework method and examine the relationship between accuracy of solution and mesh size. The examples also are analyzed by the finite-element method of Melosh, using his trilinear displacement element. Results from these numerical engineering methods are compared with the appropriate elasticity solutions given by Timoshenko and Goodier. In both cases the pinned model idealization was used and only cubic elements were employed to facilitate programming. The equivalent space-framework method provides a useful engineering approach to the stress and strain analysis of solid bodies, particularly in view of its ability to utilize computer programs readily available to practicing engineers.

R202681X67A

Yettram, Alan L and Robbins, Kenneth
SPACE-FRAMEWORK METHOD FOR THREE-DIMENSIONAL SOLIDS
ASCE Proc, Jour Engg Mech, Vol 93, No EM6, Paper 5633, pp 21-36, Dec 1967.
U of Leeds, G B, 16 p, 8 fig, 2 tab, 11 ref, 2 append
DESCRIPTORS-- three-dimensional/ *structural analysis/ matrix algebra/
*mathematical analysis/ stress/ *stress analysis/ stress-strain curves/
programs/ models/ numerical method/ elastic theory/ solids/ shear stress/
triaxial stress/ Poisson ratio/ joints/ torsion/ stiffness/ computers/
*engineering mechanics
IDENTIFIERS-- *mathematical models/ finite element method/ Great Britain/
foreign research

WATER-PLANT-SOIL RELATIONS

R202641 67A RADIOACTIVE TRACERS IN DIFFUSION TESTS

Use of radioisotopes for viscous or molecular flow experiments is useful mostly because of the complete analogy between the flow of the tagged and untagged species. The analogy requires that the equation of flow and initial and boundary conditions would lead to similar solutions for the 2 isotopes. In many cases a correction for the decay in radioactivity leads to such an analogy; however, in the presence of adsorptive processes or flow with sinks, the mathematical analogy may fail. This limitation occurs with time-dependent sinks, but it sometimes can be alleviated; e.g., if the radioactive tracer is of long half-life compared with the length of the experiment.

R202641 67A

Mokady, R S and Zaslavsky, D
ON THE USE OF RADIOACTIVE TRACERS IN DIFFUSION EXPERIMENTS
Soil Sci Soc of Amer Proc, Vol 31, No 5, pp 604-608, Sept-Oct 1967. Israel
Inst of Tech, Haifa, 5 p, 2 fig, 5 ref
DESCRIPTORS -- *radioactive isotopes/ *tracers/ *diffusion/ *dispersion/
experimental data/ flow/ groundwater flow/ sinkholes/ soils/ viscous flow/
phosphorus/ *isotopes/ half life/ radioactive decay/ adsorption/ porous
materials/ *soil science/ phosphates
IDENTIFIERS -- porous media/ foreign research/ Israel

R202667X67A CLIMATE AND EVAPORATION FROM CROPS

Loss by evaporation (E) from well-watered crops can be estimated from measurements of the temperature (T) and the global-radiation intensity (Q sub s), using some empirical relationship between T and the ratio LE/Q sub s, in which L = the latent heat of evaporation of water. Relationships that have been proposed are corroborated roughly by data from outside the U S, but considerable scatter exists. This is partly caused by the effects of humidity and cloudiness variations, allowed for in the new equation for the ratio. The theory shows that the ratio LE/Q sub s depends not only on temperature, but on crop characteristics, climatic relative humidity, and the daily duration of bright sunshine. Thus, derivation of the ratio from temperature alone is unlikely to lead to reliable estimates of the evaporation rate. Gives 64 references.

R202667X67A

Linacre, Edward T
CLIMATE AND THE EVAPORATION FROM CROPS
ASCE Proc, Jour Irrig & Drng, Vol 93, No IR4, Paper 5651, pp 61-79, Dec 1967. Commonwealth Sci & Ind Res Orgn, Griffith, Australia, 19 p, 10 fig, 2 tab, 64 ref, 3 append
DESCRIPTORS-- *crops/ *evaporation/ *climatology/ irrigation/ humidity/ temperature/ bibliographies/ evapotranspiration/ *plant (botany)/ agronomy/ clouds/ radiation effects/ forecasting/ *grasses/ estimating/ *consumptive use (water)
IDENTIFIERS-- worldwide/ foreign research/ Australia/ correlation

Instrumentation for tracing dispersal of sewage in the sea is discussed. The tracer bromide-82 is added continuously to the flow of sewage entering the sea through a submerged outfall or alternatively as a single dose to the sea at the site of a hypothetical outfall. The dispersal is mapped by scanning the area with gamma-scintillation counters towed by a boat to sites of predetermined depths; the depths are monitored continuously by simple echo sounders. Counting rates, after scaling by a factor of 10, are recorded as pulses on individual tracks of a multichannel tape recorder; other tracks are used for timing pulses. The tapes are replayed on shore and the recorded information is transferred to conventional chart recorders or scalers. Results of typical surveys are given. Double-labeling techniques are described. By use of a nonadsorbable tracer to label the liquid phase and a highly adsorbed tracer to label the solid phase, segregation effects can be studied. The technique was used to demonstrate the short circuiting of solids in a sludge-digestion system and compare relative retention periods of dissolved and suspended matter in a percolating filter. By simultaneous addition of a nonadsorbed tracer and the radioisotope under investigation, reversible adsorption on the bed of a stream or on walls of a sewer can be detected.

R202634 67A

Eden, G E and Briggs, R
RADIOISOTOPE TECHNIQUES DEVELOPED IN WATER-POLLUTION STUDIES
Proc, Intl Atomic Energy Agency Symp on Isotopes in Hydrol, Vienna,
Austria, pp 191-206, 1967. Ministry of Technol, Stevenage, G B, 16 p, 9
fig, 4 tab, 6 ref, disc
DESCRIPTORS-- *radioactive isotopes/ *water pollution/ suspended solids/
pollution abatement/ water quality/ sewage/ tracers/ sanitary engineering/
*recording systems/ cobalt/ digestion tanks/ sewers/ sewerage/ streamflow/
lithium/ bacteria/ hydrology/ adsorption/ gamma rays/ labels/ seas/ oceans/
instrumentation/ measuring instruments
IDENTIFIERS-- bromides/ nuclear probes/ nuclear engineering/ Great Britain/
foreign research

R202637 67A FLOW OF A STREAM THROUGH A RESERVOIR

If a reservoir is fed from a single source, which is not always pure, the extent to which the inflowing stream mixes with the water in the reservoir is important for the quality of water supplied from the reservoir. This problem was investigated at the Lingese Reservoir, an industrial reservoir with a capacity of 2 million cu m of water, located in the North Rhine-Westphalia District of West Germany. So that varying effects of the stream-water temperatures could be studied in relation to the temperature of the reservoir water, investigations were made during 4 different seasons. The stream was radioactively labeled at its point of inflow to the reservoir and its flow through the reservoir measured in length and depth with geiger counters. In 2 cases, radioactivity of the outflowing water was measured at fixed points. A considerable variety of intermixing phenomena was observed mainly for limnological interest. Results of these seasonal experiments are described in detail. Comparisons were made with simultaneously performed dye and salt experiments, but the 4 seasonal experiments using isotopes were found to be more suitable than the other procedures for investigating limnological processes and evaluating them quantitatively.

R202637 67A

Sauerwein, K
THE FLOW OF A STREAM THROUGH A RESERVOIR
Proc, Intl Atomic Energy Agency Symp on Isotopes in Hydrol, Vienna,
Austria, pp 697-719, 1967. Gemeinnutziges Inst, Dusseldorf, W Germany,
23 p, 14 fig, 1 tab, disc
DESCRIPTORS-- *water quality/ reservoirs/ flow/ *limnology/ *radioactive
isotopes/ geiger counters/ industrial water/ municipal water/ chemical
properties/ investigations/ mixing/ fluid flow/ air temperature/ wind
speed/ water/ temperature/ water currents/ experimental data/ density/
thermal conductivity/ *streamflow
IDENTIFIERS-- West Germany/ Lingese Resvr, W Germany/ domestic water/
*evaluation/ biological properties/ foreign research

R202646X67A OPTIMUM DESIGN OF FLASH EVAPORATORS

A simple cost model developed for optimizing the design of flash evaporators can be used as a tool for studying the sensitivity of optimum design to variations of independent economic and physical parameters. For fixed water output, variable annual cost is minimized by varying the number of stages, terminal temperature differential (TTD), and condenser tubing diameter. Variable annual cost is assumed to consist of the variable portions of amortization, steam, and pumping costs; operating cost is assumed to be fixed. The variable amortization cost is assumed to include tubing cost proportional to the tubing area and variable shell cost proportional to the number of stages. Sensitivity of optimum design to the mode of optimization is shown; by allowing tube diameter, number of stages, and TTD to vary, a completely different optimum design is obtained. Results of the application of this cost model to a design study are presented.

R202646X67A

Wolberg, J R
ANALYSIS OF THE OPTIMIZATION OF THE DESIGN OF FLASH EVAPORATORS
Desalination, Vol 2, No 3, pp 299-307, 1967. Israel Inst of Tech, Haifa,
9 p, 3 fig, 10 tab, 4 ref
DESCRIPTORS-- *optimum design/ costs/ temperature/ steam/ economics/ heat
transfer/ *models/ scale/ corrosion/ fabrication/ fluid flow/ velocity/
water costs/ *demineralization/ *evaporators/ design/ analysis
IDENTIFIERS-- *flash evaporators/ operating costs/ brines/ desalination/
foreign research/ Israel

R202672X67A TOTAL MANAGEMENT OF WATER RESOURCES

Application of the concept of total management of water resources is discussed. Two definitions of the concept are: (1) the highest possible recycling of our available waters and (2) the wisdom and desire to use our water resources so society can choose among alternative investments in such diverse areas as water development, national defense, or urban development. Inadequate technology, uncertainty as to ultimate goals, and lack of institutional capability severely limit application of either concept. Water management cannot fulfill all of society's demands because the demands conflict and their aggregate exceeds the potential water supply. A rational basis for choice is needed, along with maximum flexibility to cope with changes in the services demanded and the priority that society accords them. Total management must be oriented toward planning, responsive to subjective values as well as to purely environmental factors, careful to avoid commitment to possibilities that may not materialize, and continually in search of new technology.

R202672X67A

Smith, Robert L
TOTAL MANAGEMENT OF WATER RESOURCES
Jour AWWA, Vol 158, No 11, pp 1335-1339, Nov 1967. Office of Sci &
Technol, Exec Office of the President, Washington, D C, 5 p, 2 ref
DESCRIPTORS-- *water resources/ water development/ water reuse/ *water
management/ water demand/ water control/ planning/ organizations/ urban
areas/ optimum use/ costs/ flexibility/ environment/ technology/ ecology/
multiple purpose projects/ drainage basins
IDENTIFIERS-- Federal agencies/ conservation

The scope of the water problem in the U S is discussed and reallocation examined as a method of solving this problem. Expanding water requirements for agricultural, municipal, and industrial uses in the U S have been met largely by developing surplus water. Reallocation of water is becoming increasingly necessary as readily available sources are exhausted and surplus water becomes more expensive to develop. The Senate Select Committee on National Water Resources published an estimated consumptive use for the year 2000 of 175,000,000 acre-ft, a 50% increase over 1954. The 17 Western States consume 90% of the water in the U S but have only 25% of the supply. Unless new sources of water are developed or consumptive uses are reduced drastically, projections of water withdrawals for the West cannot be realized. Use of meters on all services and adjustment of water rates to affect economic demand can modify the trend of increasing per capita use. Has 16 references

R202673X67A

Flack, J Ernest
MEETING FUTURE WATER REQUIREMENTS THROUGH REALLOCATION
Jour AWWA, Vol 59, No 11, pp 1340-1350, Nov 1967. U of Colorado, Boulder,
11 p, 2 tab, 16 ref
DESCRIPTORS-- *water requirements/ *water demand/ *water management/ water
resources/ water reuse/ bibliographies/ *water rights/ municipal water/
consumptive use (water)/ metering/ cost comparisons/ return flow/ water
quality/ industrial water/ water laws/ appropriations/ water metering
IDENTIFIERS-- water shortages/ water transfer/ water use

R202687X67A OHIO RIVER WATER QUALITY CRITERIA

This fourth report of the Aquatic Life Advisory Committee to the Ohio River Valley Water Sanitation Commission establishes new and revised criteria for water quality. Water quality criteria are defined as the requirements of aquatic life which will permit a sustained yield of desired game and commercial fish and maintenance of a well-rounded fish population. Criteria are relatively inflexible since they are based on professional conclusions relating to the biological needs of the organism. Previous recommendations on criteria for dissolved oxygen, temperature, pH, radioactivity, and toxicity are updated. For the first time in this series of reports, the committee has developed recommendations on the protection of aquatic life in mixing zones immediately below waste discharge points. Has 17 references.

R202687X67A

Horton, Robert K
AQUATIC LIFE WATER QUALITY CRITERIA
Environ Sci and Technol, Vol 1, No 11, pp 888-897, Nov 1967. Aquatic Life
Advisory Committee, ORSANCO, 10 p, 17 ref
DESCRIPTORS-- water analysis/ *water pollution/ stream pollution/ rivers/
*aquatic life/ bibliographies/ *fish/ fish and wildlife/ dissolved oxygen/
temperature/ pH/ toxicity/ mixing/ waste disposal/ *pollution abatement/
sanitation/ radioactive contamination/ standards/ *water quality/ water
resources/ limnology
IDENTIFIERS-- Ohio River/ mixing length/ thermal pollution/ water biology/
aquatic ecology

MISCELLANEOUS

R202693X67A SPECIFICATIONS--PREPARATION AND USE

Specifications are complex documents which must be thoroughly understood by producers and users so that the resulting product will serve its intended purpose. This 5-part article tells how specifications are conceived, developed, prepared, applied, updated, and revised. Performance, design, and material specifications are discussed, with details spelled out to help avoid potential disputes. The responsibility and influence of technical organizations such as the ASTM and USASI (United States of America Standards Institute, formerly American Standards Association) are reviewed. Although the USASI is now operating as a private organization under the laws of New York State, its organization and bylaws are designed so that eventually it can be operated under a Federal charter. At that time, its position as America's official representative in the International Standards Organization (ISO) and associated groups will be reinforced.

R202693X67A

Fleischmann, Walter L

SPECIFICATIONS--THEIR PREPARATION AND USE

Metal Progress, Vol 91, No 4 thru 6, & Vol 92, No 1 & 3, pp 101-104, 86-88, 100-102, 71-73, & 101-102, Apr thru July & Sept 1967. General Electric Co, Schenectady, N Y, 15 p, 1 photo

DESCRIPTORS -- *specifications/ preparation/ *standards/ codes/ materials/ *supply contracts/ purchasing/ safety/ procurement/ quality control/ management/ *contracts/ contracting

IDENTIFIERS-- accuracy/ American Soc for Test & Mat/ USA Standards Institute

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